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# Engineering and Mining Journal

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## NORDBERG HOISTS

### IN ALL SIZES

Engineers are well acquainted with the reputation of the Nordberg Mfg. Co. for building large steam hoists, as for example, the many Corliss Hoists in the Michigan copper country, and recently many large electric hoists including that now under construction for the Butte & Superior Copper Co. (3,600 hp.)

But many are not so familiar with the Nordberg line of moderate size hoists, such as that illustrated.

This shows a Nordberg Cylindro-conical Drum Hoist built for Pickands, Mather & Co., for their Utica Mine. The drum diameters are 4 ft. 6 in. and 6 ft. 6 in., grooved for 500 ft. of $1\frac{1}{8}$-inch rope. The hoist is geared to a 150-hp. motor, through cut herringbone gears. It is fitted with Nordberg parallel motion post brakes, one operated by the safety stop, the other by hand. The brake equipment, drum, frame, bearings and safety stop, and other features of this hoist are similar in design to the largest Nordberg Electric and Steam Hoists.

**Nordberg Hoisting Equipment has an enviable reputation for safety and dependability.**

Electric and Steam Hoists are described in Bulletins Nos. 24 and 23 respectively.

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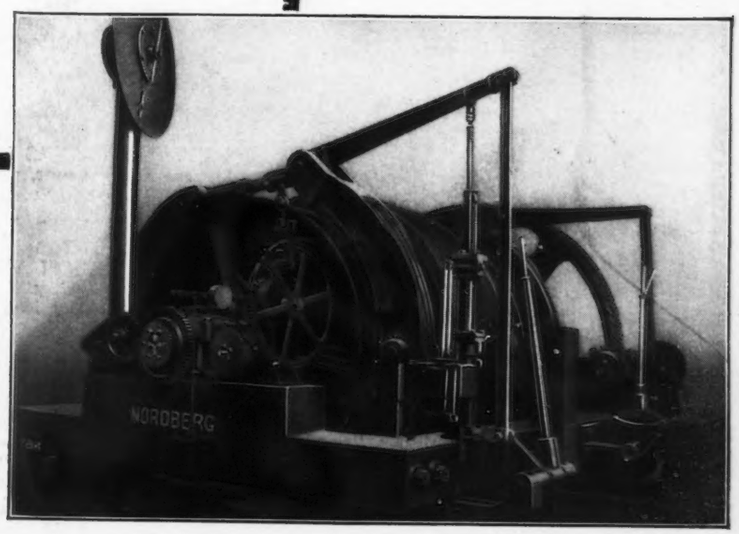

# The S-A Page

**Published Weekly in the Interests of S-A Conveying Engineering**

## Handling Low Grade Ore Profitably

The problem every mine owner has to solve in handling low grade ores is the crushing cost and handling cost. Reduce to the minimum and profits are in direct proportion to the reduction. Facts you will admit without argument.

One mine the writer has in mind not so long ago handled its entire volume of ore on an extensive system of cars, carrying from the bins to the crushers and thence to the reduction mill. Today "S-A" Equipment does the same work at less cost and with much less labor.

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What "S-A" Machinery is doing for this mining company to make it profitable to handle low grade ore it will do for you. Put your ore conveying problems up to the "S-A" engineers. Advice, preliminary plans and cost estimate gladly furnished.

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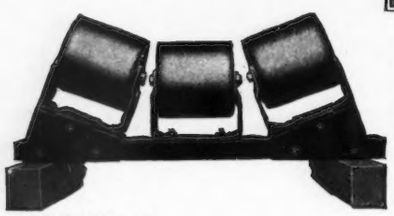

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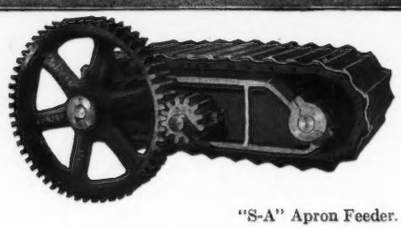

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FIG. 1. PINNACLES TYPICAL OF A ZINC-CARBONATE OPENCUT

The country rock is the Cambro-Silurian Shenandoah limestone, which is at least 4,000 ft. thick and characteris-

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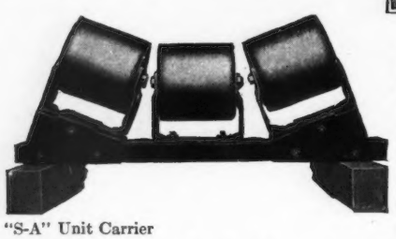

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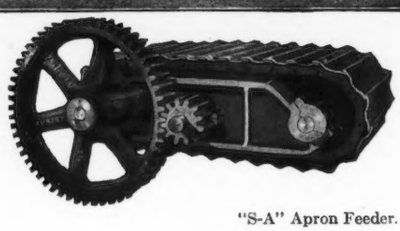

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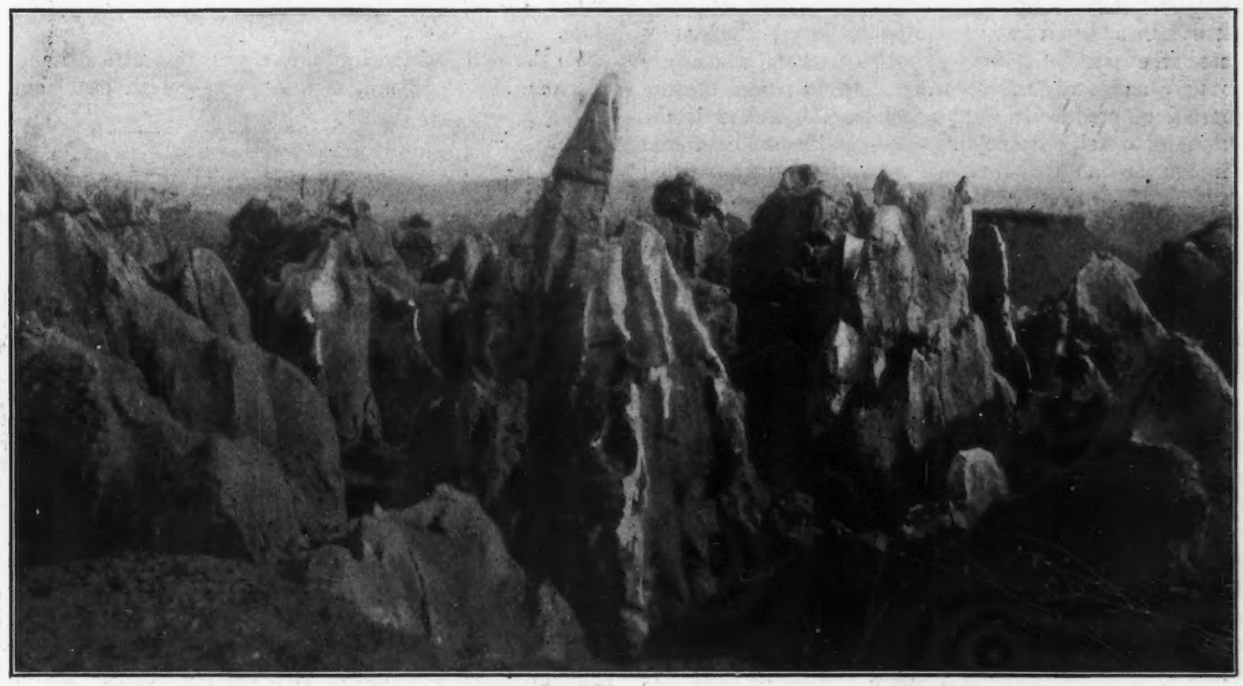

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tically is a heavy-bedded dark-colored dolomite. This formation and the overlying and underlying rocks in Wythe and Pulaski Counties are greatly disturbed. Close folding and parallel overthrust faulting along east-northeast-west-southwest axes are well developed. There are at least seven major overthrust faults in the region in question. Locally normal faults are prominent.

### Ore More Common in Lower Limestones

The orebodies are not confined to any particular horizon of the Shenandoah limestone, although perhaps more common in its lower rather than in its upper half. They are generally associated with unusually disturbed strata. The orebodies are tabular in form, with their greatest dimensions parallel to the bedding of the limestone, and replace beds of limestone crushed during folding or faulting. Several orebodies may occur in different portions of a single limestone bed, and in a single locality from three to six limestone beds may be mineralized. In instances, however, the orebodies occur along strike-faults which cut the bedding-planes at various angles. The immediate country-rock is more or less completely replaced by rather coarse white calcite, and calcitization usually extends beyond the limits of sulphile mineralization. The sulphides, while predominantly replacing the limestone, fill such breccia and other cavities as were available during ore deposition. The limits of the orebodies are usually gradational, although the ore frequently stops abruptly laterally upon encountering a fault or joint plane. In addition to such faults and joints which antedated the mineralization, there are others which are younger and fault the orebodies. In instances the ore consists of practically solid sulphides, but as a rule the sulphides of either fine or coarse grains are scattered through the limestone itself with or without the associated gangue minerals.

The principal primary sulphide is sphalerite with which is associated pyrite and some galena and marcasite, and rarely chalcopyrite. Contemporaneous gangue minerals named in the order of their abundance are dolomite, calcite, fluorspar, barite and quartz. Fluorspar at several of the prospects is the most prominent gangue. Sulphides of known secondary origin are sphalerite, galena, chalcocite and greenockite. Most of the primary sphalerite is of a honey-yellow color, although some is steel gray and evidently ferruginous. All the known secondary blende is of a honey-yellow color. Other secondary minerals include smithsonite, calamine and limonite in considerable quantities, some cerussite, calcite and hematite, and a little gypsum, malachite, native sulphur and manganese oxide. As Doctor Watson states, the ore-depositing waters were undoubtedly ascending, as is indicated by conditions at the Chamberlain mine, near Rye Valley. Here two small parallel veins of galena occur in limestone beds immediately beneath bands of comparatively impervious shaly limestone. Small spurs extend up into the shaly limestone. Of similar significance is the fact that at Austinville the hanging walls of the orebodies are well-defined planes parallel to the bedding, and the foot walls are ill-defined and irregular, the passage from ore to rock being gradual. The location of many of the orebodies near or upon the crests of anticlines is of similar import.

Several observations, however, suggest strongly that the orebodies were deposited by waters of magmatic origin and not by meteoric waters. Perhaps the strongest indication is the situation of the orebodies themselves. North of the ancient rocks of Carroll County, Virginia, there are in Wythe and Pulaski Counties and in the two counties still farther north (Bland and Giles) certainly five, and possibly six successive bands of Shenandoah limestone, which extends N 70° E to S 70° W. Faults parallel to the strike of the limestone are apparently equally abundant and equally important in each of these bands. Notwithstanding such conditions, all the important ore occurrences are confined to the most southerly limestone band. There are a few minor deposits in the next band to the north, but blende and galena in the three or four more northerly bands are, as far as known, mineralogic curiosities. In southwest Wisconsin and in Washington County, Missouri, where the lead and zinc ores were quite certainly derived from overlying sedimentary rocks and deposited by descending meteoric waters, the orebodies are dotted irregularly over the respective districts without orderly alignment. Were the southwest Virginia deposits of such an origin, it would appear that they should occur not in one but in all of the Shenandoah limestone bands, as all appear equally favorable to ore deposition. The distribution at least suggests the influence of an underlying igneous rock beneath the most southerly Shenandoah limestone band. Outcrops of igneous rocks younger than the Shenandoah limestone are unknown, however, in the lead and zinc region, although not absent in neighboring portions of the state.

To the south of the lead and zinc region at a distance of from 7½ to 12 mi., is the "great gossan lead" and its less important parallel veins. This, as is well known, is an exceedingly strong pyrrhotite-pyrite vein of magmatic origin. The course of this vein and the strike of the lead and zinc orebodies coincide. It is not believed that there is any direct relation between the two types of orebodies, and it is not even known that they are contemporaneous, but the two types of orebodies at no great distance from one another occupy parallel and possibly contemporaneous planes of structural weakness.

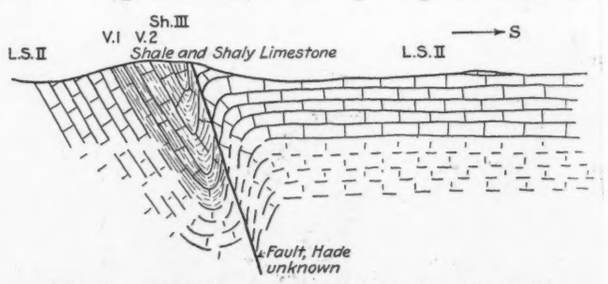


FIG. 2. SECTION AT THE CHAMBERLAIN MINE, SUGAR GROVE, VIRGINIA

Fluorite is a common gangue in the region and is locally abundant at the Simmerman property near Ivanhoe and at the Keesling property at Cedar Springs. In some regions it is probably transported and deposited by meteoric waters, but its abundance at these two deposits is strongly suggestive of magmatic waters.

The texture of the sulphide ore at certain of the prospects, particularly those near Allisonia, is also indicative of magmatic rather than meteoric deposition. The very considerable depth at which drill holes are reported to have cut ore at one property is certainly not against the former origin.

A trace and even weighable quantities of antimony are reported from the ore, and in instances traces of gold have been found. Where lead is present with the sphalerite, small but appreciable quantities of silver are usually present. The silver content usually increases with an increase in the amount of galena present, the sphalerite being probably nonargentiferous. In the following assay results from a single property, the percentage of lead is given, together with the corresponding silver content in ounces: Pb, 0.01, Ag (nil); 0.1 (nil); 0.1 (0.01); 0.3 (nil); 0.3 (trace); 1 (nil); 2.1 (0.03); 2.8 (0.4); 3.1 (0.2); 5 (0.08); 10 (0.7); 52.1 (concentrate) (1.6); 78 (picked sample) (5). These figures indicate an average silver content of a little over 5 oz. per ton of lead. This small silver content is nevertheless considerably greater than the average of the Joplin, Mo., or southwest Wisconsin lead and zinc districts, which were without much doubt deposited by meteoric waters, and is more than double that of the southeast Missouri disseminated lead ores, which by most authorities at least are considered to have been deposited by meteoric waters.

The calamine and smithsonite derived from the sulphide deposits have been frequently and excellently described. Oxidized ores were formed to some extent by the oxidation of these sulphides in place, but these secondary ores were to a larger extent reprecipitated around and particularly at the base of the limestone pinnacles so characteristic an accompaniment of the oxidized ores. In part the oxidized ores replace the limestone along fractures as both crystalline and globular bodies, the softer

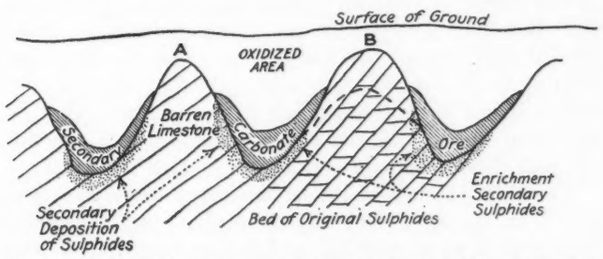


FIG. 3. SHOWING RELATION OF SECONDARY SULPHIDES AND CARBONATES

and more "sandy" (decomposed) limestone being more readily replaced than the hard unaltered limestone. Many of the zinc carbonate opencuts were originally iron-ore pits, and recently some of the oxidized zinc deposits have been mined for limonite iron ore. As a rule where iron ore predominates in the clay, the pinnacles are well rounded and loaf-shaped and composed of solid rock; where much zinc ore is present, however, the pinnacles are remarkably uneven and jagged in form and the limestone decomposed to a sand-like mass. Brecciation of the limestone composing the pinnacles in zinc deposits is also much more common than in those producing predominantly iron ore.

Secondary sulphide enrichment is common, although commercially of no great importance, and in deposits in which original sulphides are not minable, the secondary enriched sulphides will probably in no instance be of economic interest. Indeed, the relatively small development of secondary enrichment is surprising, considering the quantity of sulphides that must have been inclosed in the rocks eroded from certain of the deposits.

It is in the limestone pinnacles that the secondary origin of some of the sphalerite and galena is most obvious. Lead and zinc sulphides are not rarely disseminated in the exterior portion of these pinnacles, and when an inch or at most 8 in. of the outside rock has been knocked off, barren limestone is encountered. Several tunnels driven through such pinnacles passed through a crust of limestone mineralized with secondary sulphide, then into barren limestone and then, as they holed through, into a thin crust of mineralized limestone. Such secondary sulphides are particularly common on the lower and middle reaches of the pinnacles.

Other secondary sulphides are not absent. For example, the ore lying in the bed of New River, one-half mile northwest of Allisonia, shows curly crustified masses of black blende, pyrite and calcite, and a little galena. Locally the pyrite has been leached out, and in the cavities well-developed crystals of rosin jack, and rarely a crystal of galena, were deposited. At the Austinville mines radiated bands of cerussite have been deposited upon iron sulphide. Protruding from and extending into the cerussite are well-crystallized cubes of galena, which are evidently of a later generation than the cerussite itself. This secondary galena, which is reported to come from a "clay" stope approximately 150 ft. deep, has itself been slightly pitted by solution. At a number of places knife-edges of rosin-jack cut calcite and rosin blende of earlier age. Of course, in this instance both generations of zinc sulphide may be primary. Sometimes such younger (although not necessarily secondary) sulphide veinlets are well developed. On the Lobdell Carwheel Co.'s property near Ivanhoe, one such vertical veinlet, cutting a sphalerite-mineralized limestone bed, consists of two discontinuous borders of sphalerite grains with barite center. A stringer of galena 4 in. wide on the Ivanhoe Furnace property, which cuts a mineralized limestone bed, is bordered for half an inch by many galena cubes.

In résumé, while it is recognized that the data presented do not prove that the southwest Virginia lead and zinc orebodies were deposited by magmatic waters, it is believed that the predominant evidence is in that direction.

## New Gold-Mining Areas To Be Opened in South Africa

The Government of the Union of South Africa has called for tenders for the leasing of two large gold-mining areas, comprising some 2,460 claims, on the Far East Rand, Transvaal, for exclusive rights to mine precious metals. Applications must received by the Government Mining Engineer, New Law Courts, Johannesburg, not later than noon on Oct. 31, 1916.

For the development and proper equipment of mines in the two areas, a total of about $10,000,000 will be required. Blueprint maps of the claims, copies of the lease and other literature may be examined at the district office of the Bureau of Foreign and Domestic Commerce, 409 Custom House, New York. Refer to file No. 80,513.

**Safety for Mexican Miners in Arizona** is one of the aims of the Arizona State Bureau of Mines at Tucson, Ariz., and beginning Nov. 1 the monthly bulletin entitled "State Safety News" will also be published in Spanish. The proportion of Spanish-speaking laborers is large in the mines of Arizona, and it is felt that they require education along "safety-first" lines more than do the straight American miners. The bulletins are distributed free.

# The Labor and Capital Problem

*SYNOPSIS—A simple analysis of the problem of distribution of wealth and income. Increased profits mean more capital seeking investment, with more opportunities for wage-earners and an improved standard of living for all classes. In the last 15 years the amount of capital employed in manufacturing, per person employed, has increased 60%. Increase of wages is dependent upon increased production rather than mere demands. Condition of the Chinese masses largely due to primitive production methods.*

The monthly circular of the National City Bank for September, 1916, contains the following simple and lucid exposition of the greatest problem in economics, which is well worth reading by everybody:

Every industrial dispute like the one between the railway companies and brotherhoods is related, of course, to the larger problem of the general distribution of wealth and income, and stimulates discussion of the whole subject. Unfortunately the discussion is usually extremely superficial. A great many people regard each dispute as simply one phase of a continuous struggle which is necessary in order that labor may win from capital a fair share of the results of their joint efforts. There is slight recognition of any general economic law governing the distribution of wealth, or of its silent but inevitable accomplishments. In the railway controversy the wage-earners are set over against the managers or shareholders, as though there was a fixed amount for them to divide and nobody else was concerned. And so there is a common assumption in industrial disputes that the only obstacle to higher wages and shorter hours is the stubborn unwillingness of employers to grant them.

### All Employers Are Not Prosperous

There is, however, an abundance of evidence to show that the lot of the average employer is far from an easy one. The Federal Trade Commission has reported, as the result of an official inquiry, that a majority of the manufacturing establishments of this country are not making even a fair profit. This is the usual situation. The leaders are always making money and raising the efficiency of industry to higher levels, while the tail-enders are always losing and in process of being eliminated. These differences in management and efficiency always exist. Industry is undergoing constant evolution, but no sudden revolution is possible. Few will deny that organization among wage-earners and legislation for the regulation of working conditions have corrected abuses and accomplished good, but the great advance that has taken place in the condition of the masses has been mainly due to the improvements in methods of production which have been worked out in the competitive struggle. The efficient organization of industry and transportation, the multiplied use of machinery, the growth of capital, the development of banking and of credit facilities, these have enormously increased the production of goods and the demand for labor. These agencies have made possible and inevitable the shorter work day and higher wage.

Organization is not a new thing among wage-earners. The strike and boycott have been known in China for centuries, and no people are more expert in their use, but the lot of the Chinese laborer has not been raised to the level of the laborers in the United States, for the reason that capital has not been applied to industry in China as it has in this country. The wheelbarrow is still the principal means of transport in China, and factory organization and factory machinery are almost unknown there. The elevation of the Chinese masses waits on these things, and when they are supplied, the lot of the workingman in China will change, as it has changed here.

### Distribution of Wealth Measured by Consumption Rather Than Ownership

The fundamental thing about the relationship of wealth to the general welfare is the fact that the final distribution is in goods and services for personal use. The fact that a man makes money enough with one factory to build another is of less significance than the fact that the output of goods is doubled. The ownership of the railways is of less significance than their service to the public. People are impressed by statements showing a large proportion of the wealth of the country in few hands, but this wealth is in productive property, to wit, farms, factories, machinery, railways, etc.; in short, in the means of providing goods and service to the public. It would be desirable, no doubt, to have the ownership of these things more widely and equally distributed than it is at present, but after all, the value of these things is not in themselves but in the products that flow out from them. All the benefits come out in the flow; the real distribution of serviceable wealth is there.

The chief interest in the ownership of productive property is in having it efficiently handled, so that the product will be as large as possible, and it may be more efficiently handled in few hands than in many. But when it comes to the distribution of products, we see that this cannot be confined to a few. Nobody wants to confine it; everybody is struggling for the largest possible distribution. The goods must go to the people. The public must buy and consume them, or the whole business of production comes to a standstill. If the owners of productive property control the market so as to increase their profits, they cannot use the profits in business except to increase production, either in their own line or some other, and there is no outlet for this increasing supply except by distribution to the public.

### Production and Consumption Must Be Equal

Production and consumption are bound to be in equilibrium. The owners of capital may combine and contrive in their efforts to make money, but the more they make and put into business the more goods there will be on the market, and unless these goods are distributed and consumed, the stream will be dammed up, production will be choked off, and further accumulations of capital will be impossible, and if possible, they would be useless. It is the growing purchasing power of the public that gives employment to new capital.

People fret and protest, and legislative bodies investigate and resolve, when oil, or paper, or wheat, or some

other commodity goes up in price and the producers are known to be making unusual profits, but these profits create a fund for the correction of the shortage, and the correction of the shortage is the vital thing. The surest remedy for high-priced capital is more capital.

In short, increasing profits, meaning as they do more capital seeking investment, are bound to result in an enlargement of the industries, the installation of more machinery, the more rapid substitution of new processes for old and a general advance in the position of the entire community, with widely distributed benefits.

Each line of industry is expanded and developed largely by means of the profits made in it, and its rate of progress corresponds to them. The money that has been made in cotton mills in the Southern States has gone back into new cotton mills and better ones, and the profits of the cotton industry in New England have gone in the same direction.

### Transfer of Capital to New Fields

Frequently, capital accumulated in one business finds other fields in which to do development work. A citizen of Atlanta, Ga., Asa G. Candler, having made a fortune in the manufacture of a popular drink known as "Coca-Cola," has invested a million dollars within the last year in perhaps the best cotton-storage warehouse in the world. It is built of concrete and equipped with a sprinkler system, and has secured an insurance rate upon cotton of 1/3% per annum, against an average rate upon cotton in miscellaneous storage of about 3½%; it is equipped with a trolley system by means of which cotton can be loaded and unloaded at a cost of 1½c. per bale, against an average cost of handling by trucks of 16c. per bale; it is equipped with a high-density compress, which secures a saving of approximately $1 per bale on ocean freights and ¼% on marine insurance. Finally, receipts for cotton stored in this warehouse make a class of collateral upon which money can always be borrowed in any money market of this country at the lowest ruling rates. This warehouse is for the service of any cotton grower or dealer or consumer. A Georgia farmer can store his crop with perfect security until he is ready to sell; a cotton-goods manufacturer in Georgia or Massachusetts may buy and store against future needs, or a trader or investor may use the facilities. Millions more are being invested in similar warehouses at Memphis, New Orleans, Houston and other points in the South.

A great many manufacturing companies are making unusual profits this year, but these profits are being used, for the most part, for strengthening the position of the companies, enlarging their capacity and putting them in condition to produce more economically in the future. These expenditures will not inure to the benefit of the owners exclusively; the natural effect will be to provide more employment and steadier employment, and to increase the supplies of goods on the market.

The Lackawanna railroad company last year completed a costly piece of cutoff construction between New York and Buffalo, building 38 mi. of new road with a great viaduct at a cost of $12,000,000, to take the place of 41 mi. of track over heavy grades and with sharp curves. In the early years of the road's history such construction would not have paid, and probably was not thought of. But now, with greater traffic, heavier equipment and higher wages, there is economy in spending more upon the roadway. The savings in moving the traffic will pay the interest on the new capital that has been borrowed and amortize the principal. There is a gain of wealth to the community, an improvement in the service, and no member of the community is so remote or so humble that the benefits of such improvements do not reach him. They are improvements in the equipment of society, and it is impossible that the effect of such changes shall not be widely diffused. They make the difference between the condition of the workingman in China and the workingman in the United States.

The capital for the 38 mi. of new road may have come from people in widely different circumstances. Some of it may have been supplied by savings banks and represented the small savings of wage-earners; some of it may have come from misers whose penurious habits are not admired; some of it may have come from the surplus income of employers who ought in fairness to pay higher wages than they do; but wherever the money came from, it is now placed where it renders a widespread service to the public. And when the interest upon this investment is turned back into a similar improvement on another railroad or into some other constructive and productive work, and as we follow down and find all of the increment going into public works, it is pertinent to ask how the private owners derive any benefit from these investments. The answer, of course, is that they derive exclusive benefits only from what they eat and wear or otherwise withdraw from public use and devote to themselves or their dependents. All the rest of their income goes to public uses as effectively as though it was donated to the public treasury. What better could the treasury do with it?

The public grievance against great private incomes narrows down to undue and wasteful personal expenditures, which, although offensive in instances, are a very small factor in the total.

### Census Figures

We have heretofore found occasion to call attention to the remarkable growth of capital as a factor in the industries of this country, but the figures are worth repeating at every opportunity. In the three five-year periods 1899-1904, 1904-09, 1909-14 the principal figures for our manufactures, as collected by the census, showed increases over those for the preceding period as follows:

| | Percentage of Increase | | |
|---|---|---|---|
| | 1904 Over 1899 | 1909 Over 1904 | 1914 Over 1909 |
| Capital employed | 41.2 | 45.4 | 23.7 |
| Primary horsepower | 33.6 | 38.5 | 20.7 |
| Wage earners, average number | 16.0 | 21.0 | 6.4 |
| Total wage payments | 30.0 | 31.0 | 19.0 |
| Value of products | 29.7 | 39.7 | 17.3 |
| Value added by manufacture | 30.3 | 35.5 | 15.8 |

This table will repay careful study. All percentages of increase were noticeably less in the last period, showing a smaller expansion of industry, and indicating that profits were lower. The tendency, however, was the same throughout all periods. The number of wage-earners shows a lower percentage of increase than either amount of capital or amount of wage-payments or value added by manufacture. (The latter term is used by the Census Bureau to indicate value of product after deducting cost of constituent materials.) The value of product added in manufacture increases by a percentage lower than the increase of capital or wage-payments, but higher than the increase in number of wage-earners.

These figures support the judgment long pronounced by economists that labor, by the inevitable workings of natural law, gets a constantly increasing share of a constantly increasing product. The wage-earners not only gain in wages, but in having their manufacturing done for them at lower cost through the increasing use of capital. If their position does not improve absolutely, the explanation must be found in the prices of materials and other things outside of the field in which labor and capital are the chief factors. Labor has unmistakably gained where labor and capital divide the proceeds of their joint efforts, but has lost some of these gains to the producers of grain, meats and other natural products.

In 1899 the amount of capital employed in manufacturing was $1,770 to each person employed, in 1904 it was $2,117, in 1909 it was $2,488 and in 1914 it was $2,848.

If all the effects of the increase in capital were on the side of prices, a greater reduction would be shown, but in part the influence is upon wages. Every increase in the supply of capital makes an additional demand for labor, and with capital increasing faster than population, as it does, there is bound to be an upward tendency in wages. Moreover, the gains in production give better living conditions, better educational advantages, with the result that wage-earners are not only more efficient but more independent and capable in making their bargains. Unless there are gains in the purchasing power of the public, either through lower prices or higher wages, a growth of production greater than the growth of population cannot be absorbed.

### The Law of Progress

It does not follow that an individual or group of wage-earners may not be interested, and justly interested, in increasing his or their wages at the expense of employers' profits. The effect may be to increase present consumption and curtail the accretions to the investment fund, or it may cause the contributions to the investment fund to reach it through other channels. The fundamental truth is that all surplus above current living expenses, whoever owns it, goes into the investment fund, the growth of which finances the progress of society. Obviously, the more there is saved from current consumption and put into productive equipment the more rapid the progress of society will be, and capital tends naturally to accumulate in the hands of people best able to use it in the creation of more capital. This is only repeating by the operation of economic law what millions of people do voluntarily when they deny themselves that their children may start life under more favorable circumstances. It is evident that if this view were accepted, much of the bitterness of industrial disputes, which arises largely from a feeling of class interest and class injustice, would disappear and with its disappearance would come more harmonious relationships, greater efficiency and more rapid progress.

### The Views of Economists

The foregoing views are not new. They have been held in substance by the leading economic authorities, but they are taught so ineffectively in the schools that the truths embodied are practically without influence in everyday life. They come to the surface, however, in nearly every treatment of fundamental conditions. A comprehensive work upon the "Wealth and Income of the People of the United States," by Dr. Willford I. King, of the University of Wisconsin, has recently appeared in "The Citizens' Library of Economics, Politics and Sociology," edited by Dr. Richard T. Ely, head of the Department of Political Economy of the same university. We take the liberty of making a few extracts which are pertinent to this discussion:

> After all reasonable allowances have been made, the fact remains, practically, that, beginning with 1870, there has been an increase in the national dividend so enormous that it cannot logically be ascribed to anything but the tremendous advance in productive power due to the revolutionary improvements in industry which have characterized the last half-century. It seems improbable that any other great nation has ever experienced such sweeping gains in the average income of the inhabitants. It has, almost necessarily, been accompanied by a great rise in the standard of living. . . .
>
> Of late we have had a period of "muck-raking" in which all things that exist have been pictured as very bad and growing worse. The misery of life, the difficulty of making both ends meet, has been over-emphasized. True, it is just as difficult to secure the articles required by our standard of living as it ever was. But our standard of living has grown more expensive. Increases in quality cost even more than increases in quantity. Our wants always have and probably always will increase with our ability to satisfy them, so that there is never any hope of winning the race with our standard of comfort. Such a race is just like chasing one's shadow. Nevertheless, to the present author, a larger per capita supply of economic goods appears to be a most distinct benefit to any nation, and the United States has been greatly favored in this line during the last 60 years. . . .
>
> The period 1850-1900 saw that come to pass in the United States which the English economists of the earlier Nineteenth Century deemed impossible—the improvement of the workingman's economic welfare to the extent that he was lifted out of the conditions formerly thought inseparable from a working life. He tasted the cup of learning; he experienced the joys of leisure and entertainment; and he so limited the size of his family as to enable his children to continue to secure these advantages. Larger income and more learning naturally brought more power and secured more respect. The army of labor became an ally to be courted or an enemy to be feared.

### Effects of Confiscation

After a careful discussion of the division of the national income among all classes, Dr. King reached the conclusion that if all rent, interest and profits were added to wages, the sum of the latter would not be increased by more than one-fourth. He says:

> It would seem improbable that, with our present national productive power, any feasible system of distribution could increase the average wage earner's income in purchasing power by more than one-fourth, and this is an extreme rather than a moderate estimate. While such a change might or might not be desirable, it would at least work no startling revolution in the condition of the employees of the United States. The grim fact remains that the quantity of goods turned out absolutely limits the income of labor and that no reform will bring universal prosperity which is not based fundamentally upon increasing the national income. After all, the classical economists were right in emphasizing the side of production in contradistinction to that of distribution. Nature refuses to yield her bounty except in return for effort expended. Demands for higher wages have never yet unlocked her storehouses.

Dr. King might have added that, saying nothing about the disorganization of industry which would result from confiscating all rent, interest and profits, and assuming that production would continue to be as great after all the incentives to leadership were removed, there would certainly be a check upon capital accumulations, with the result that additions to the productive equipment would be correspondingly reduced. Society would use up more of its current earnings in current consumption, and industrial progress would be retarded accordingly.

# The Roasting of Blendes*

By Maurice V. M. de Lummen†

*SYNOPSIS—A study of three systems applicable to the roasting of Australian concentrates, the ones considered comprising the Hegeler, Spirlet and Delplace. Without reference to the labor required and its cost, the Delplace furnace is considered the best, as the blende is well roasted in it and the gas is rich in $SO_2$. Highly skilled labor is required, however, and for this reason the Hegeler furnace, although making a poorer gas and more dust, is more popular in the United States, since it can be operated with ordinary labor. With the Spirlet furnace, reduction of the number of workmen is the principal feature. Data of operation and comparative costs are given.*

The question of the roasting of the Australian concentrates for the extraction of zinc being a timely one, it would be of interest to examine closely the special features of some furnaces employed for this purpose. We will content ourselves with the study of three systems: Hegeler, Spirlet, and Delplace. A description of these apparatus is unnecessary, as their arrangement is known. The Hegeler furnace is used in America by all the works roasting blende and making sulphuric acid. The great majority of the Belgian and German works use hand furnaces, the older ones the Rhenania (Hasenclever) furnace, the modern works the Delplace furnace, which has entirely supplanted the former. In late years the mechanical Spirlet furnace has been tried and put up in several works on the Continent, and its use seems likely to become general in many cases.

## Features of the Delplace Furnace

Putting to one side the question of labor and only considering the desulphurization of the blende and the manufacture of sulphuric acid, from every point of view the Delplace furnace is absolutely matchless. The blende is roasted to the utmost possible limit, and the gases produced are rich in $SO_2$ (6½%). The liberation of the gas, and consequently the feeding of the lead chambers, is absolutely regular, and the consumption of fuel is a minimum (10 to 13%). From the nature of the furnace, the quantity of dust produced is infinitesimal and may in practice be considered as negligible. This is important both from the economic point of view considering the value of the unit of zinc in the ores and from that of trouble in working. In fact, there are never any stoppages for repairs, and on leaving the works in the evening, one is certain of finding the furnace working as well on the next morning as it was the night before, which unfortunately is not always the case with mechanical furnaces. From the economic point of view the Delplace furnace, despite the high number of workmen it requires, would be able to compete successfully in Europe against the Hegeler. Its only drawback is that of labor. The difficulty not being simply the number of workmen needed, but the fact that a man requires two or three days' practice in order to work skillfully. Under these conditions, if at the time of changing shifts there is any man missing, the working of the furnace is partly disorganized. Continental works, with a view to avoiding this inconvenience, make a practice of taking for the acid factory and for such accessory services as ore and fuel, transport workers with previous experience of the working of the furnaces. By this means there is always a supply of men in reserve. This method of procedure is obviously not possible where labor is very mobile, as in the United States.

## Disadvantages of the Hegeler Furnace

If the characteristics of the Hegeler furnace are examined, it will be seen at once that there are a number of weak points. The number of workmen is high for a mechanical furnace, while the motive power required and the consumption of fuel are enormous. If the working of a furnace is followed for several weeks, it will be found that the $SO_2$ content of the gases is very low (4 to 5%), very irregular, which is not favorable to good operation of the acid plant. As a consequence of the very principle of the furnace, the ore is raked only at long intervals, nearly every two hours, and only during a few minutes each time, which is evidently unfavorable to good roasting. The quantity of dust produced is great, and the loss of zinc from this cause may reach 5 or 6%, wherefore the need for large dust chambers or special installations for the recovery of the zinc carried over. Stoppages of the furnace by reason of accidents to the machinery are frequent, and it is not rare to have a furnace shut down for 5 or 6 hr. It is needless to speak of the state of the acid plant when a single furnace roasting 40 tons begins working again after so long a stoppage. It is also unnecessary to mention the quantity of nitric acid required in order to get the chambers in good operation again.

In spite of all these disadvantages, the use of the Hegeler furnace is general throughout the United States, which is explicable if one considers the labor conditions of that country and the standpoint of the American zinc works. These cannot count on their workmen, who frequently move from works to works, and moreover, the dominant idea up to late years has been to desulphurize the blende sufficiently in order to be able to treat the roasted ore in distilling furnaces for the extraction of the metal. In these circumstances a mechanical furnace such as the Hegeler, with which any workman, without previous experience but under the control of a few experienced men, can insure a sufficient roasting of the blende is bound to succeed where the question of the cost of roasting is subordinated to that of its continuity.

## The Spirlet Furnace on the Continent

The operation of the Spirlet furnace always requires a little more attention than the Hegeler, the former being much less primitive. The two plants cannot be compared; besides, the Spirlet has been developed for Continental conditions of working. The dominant idea is the reduction to a minimum of the number of workmen while securing a roasting of the blende as good as with

*From an article in "Chemical Trade Journal and Chemical Engineer," London, England.

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the best hand furnace and a fuel consumption as low as possible. So far as the number of workmen is concerned, this is much lower than with the Hegeler. The motive power is not great, and the fuel consumption is lower than with any other type. This latter advantage results from the principle of the furnace, which tends to the great concentration of the heat. The height of the compartments of the furnace being nearly the same as that of the shelves of a Delplace, the Spirlet permits, like the latter, of the obtaining of gases rich in $SO_2$. The fall of the ore from one stage to another being low, the quantity of dust carried over is much less than with the Hegeler. The loss of zinc carried over with the dust varies from 1 to 2%. The low height of the compartments of the Spirlet is a consequence of the main feature of the apparatus; namely, the absence of metal parts in the interior of the furnace. This very considerable advantage from the point of view of cost of upkeep and regularity of working is not sensibly influenced by the inconvenience of having to stop a furnace when the number of broken teeth becomes too great for the blende to be properly raked. Evidently the success of the Spirlet is connected with the use of a refractory material of the highest quality.

### Comparative Data of the Three Systems

The following is a comparison of the expense of a plant to treat 40 tons of Australian concentrates per 24 hr. with each of the three apparatus; the labor, fuel and power requirements are also compared:

Delplace—Three batteries of furnaces, each burning 14 tons per 24 hr.; cost, including buildings, accessories, and royalty, £9,000. Labor: For the working of the furnaces, transport of ore and fuel, and for heating, 50 men are needed, plus 2 foremen, or a total of 52 men; fuel consumption, 12%; power, none.

Hegeler—The cost of the furnace, properly so-called in the United States, varies from £12,000 to £15,000. Let us take the minimum figure of £12,000. The cost of the building and of all accessory apparatus is about £3,000. The total cost of the furnace ready for work is therefore £15,000. Labor: For the working of the furnace, transport of ore and fuel, heating, and upkeep, 20 men are required, plus 2 foremen, or a total of 22 men; fuel consumption, 30%; power, 35 hp.

Spirlet—With Australian concentrates it is preferable not to exceed 5 tons per furnace. A battery of 8 furnaces is needed, plus 1 in reserve, or a total of 9 furnaces. A furnace completely installed costs, including royalty, £1,280. The cost of the building with accessories is about £2,000, or a total cost for the installation of £13,520. Labor: For the operation of the furnaces, for transport of ore and fuel and for heating and upkeep, 16 men are necessary, plus 2 foremen, a total of 18 men; fuel consumption, 10%; power, 16 hp.

Taking wages at 5s., including foremen (since two are required in each case), 10s. per ton for fuel, 15% for depreciation and interest on capital, and 0.7d. per hp.-hr., the roasting costs are given in the accompanying table. The prices given for each installation—namely, £9,000, £15,000 and £13,250—are based on the prices ruling before the war.

In spite of the difference in cost between roasting with mechanical and with hand furnaces, the great majority of blendes treated by the Continental works are roasted in hand furnaces. This is due to various reasons, among which I would note the possibility of recruiting labor without too much difficulty, the qualities of the Delplace furnace, and also the fact that the Hegeler is looked upon as impossible under the conditions of Continental working. During the latter years preceding the war, the question of labor became much more acute in many Belgian and German industrial districts, so that the interest excited by the appearance of the Spirlet furnace was all the greater. At any rate the choice of the mode of roasting depends on different factors peculiar to each case, and above all on local conditions, as the question presents itself differently to the zinc works obliged to roast its own blende and to whom the acid is a byproduct, from the acid maker roasting blendes for the zinc works. In the latter case, the acid being the principal product, these works must employ a type of furnace which, while leaving the least sulphur possible in the roasted blende, permits of the most regular and economical working of the lead chambers.

COST OF ROASTING PER TON OF MATERIAL

| | Delplace | Hegeler | Spirlet |
|---|---|---|---|
| Wages | £13 | £5 10s. 0d. | £4 10s. 0d. |
| Per ton ore | 6s. 6d. | 2s. 9d. | 2s. 3d. |
| Coal | 4.8 tons | 12 tons | 4 tons |
| Per ton ore | 1s. 2½d. | 3s. 0d. | 1s. 0d. |
| Power: | | | |
| Per ton ore | ..... | 1s. 2½d. | 7d. |
| Depreciation and interest | £1,350 p.a. | £2,250 p.a. | £1,987 p.a. |
| Per ton ore | 1s. 10d. | 3s. 1d. | 2s. 8½d. |
| Repairs and maintenance: | | | |
| Per ton ore | 2d. | 1s. 3d. | 1s. 0d. |
| General charges: | | | |
| Per ton ore | 7d. | 1s. 0d. | 1s. 0d. |
| Total cost of roasting per ton | 10s. 3½d. | 12s. 3½d. | 8s. 6½d. |

## "Lands Forlorn"

George M. Douglas has written a fascinating story (published by G. P. Putnam's Sons) of an expedition to Hearne's Coppermine River, which flows into the Arctic Ocean. He was accompanied by August Sandberg, geologist for Phelps, Dodge & Co., and by Lieut. L. D. Douglas, R. N. The book is beautifully printed and is illustrated by an uncommonly fine collection of photographs, which give a better idea of this barren northland than anything else we have ever seen. We fear they are flattering, for they do not show such an inhospitable country as we imagined. Moreover, Mr. Douglas and his companions appear to have had an agreeable time of it, although they had plenty of hardships. We fancy that in writing of them in after time, Mr. Douglas took a genial view of them. Anyway, his book is superior in human interest and in many other things to most books of travel. The following introduction by Dr. James Douglas will be of interest to everybody:

"My cousin, George Mellis Douglas, the leader of the expedition described in this narrative, is an engineer and has had wide experience of small craft. After years of work in the arid Southwest, he was naturally seized with an uncontrollable thirst for water, and one day told me of his longing to explore some one of the rivers flowing into the Arctic Sea. Half in jest I undertook to "grubstake" him if he would report on the copper-bearing rocks of Hearne's Coppermine River. He accepted the challenge. And this book is one of the results. It contains a narrative of travel in arctic Canada by three youths without native guides, who brought back scientific information of great interest and importance. Hearne's Coppermine River, flowing into the Arctic Ocean in Lati-

tude 68° 49′ N, and Longitude 115° 32′ W, was chosen as offering an exceptionally interesting field for exploration, partly because the results might have a final commercial value.

"In his introductory chapter the author describes how rumors and proofs of great copper deposits among the mountains in the far north prompted the earlier explorations of that inhospitable land. The Indian tales of the remote copper mines were as far from accurate as is many a mining report in the prospectus of a modern promoter. Instead of a mountain of copper Hearne found one lump of metal, which he picked up "among a jumble of rocks." Copper may once have been more prodigally exposed, but for centuries the croppings had been searched for float metal by the Eskimos and by the Coppermine River Indians, who used it as an article of barter over the whole Northwest. It was carried by them eastward to the Hudson Bay and westward to the Pacific. The Eskimos are said still to prefer it for certain uses to iron.

"Dr. Sandberg examined and mapped only the section of the Copper Range immediately west of the Coppermine River, but the party followed the same traps to the Dismal Lake and found them strewn on the shores of Great Bear Lake 150 mi. west of the Coppermine River. Simpson, Hanbury and others picked up metallic copper on the beach of the islands in Bathurst Inlet. Thus these rocks, with a general northeast and southwest strike, have been traced for some 300 mi., and if the same rocks really appear in Victoria Land, where Stefansson describes the Eskimos as gathering copper, their cross-section must be vastly greater than the corresponding series on Lake Superior. The total area, therefore, within which copper ore may possibly be found, covers nearly 10,000 sq.mi.

"Whether profitable ore occurs anywhere in this district can be determined only by a thorough survey, followed, should favorable indications be found, by exploratory development on an extensive scale. Our three explorers confirmed Sir John Richardson's diagnosis of the identity of these copper-bearing rocks with the melaphyres and conglomerates of the Keweenaw series of Lake Superior. This was conclusively proved by Graton's petrological examination of the hundred samples of rocks brought out by our explorers. On analysis a large proportion of these rock samples contained traces of metallic copper—two of them were ores of profitable grade. What they did for the first time was to trace and map the succession of beds that compose this interesting—possibly commercially important—group of rocks. In this work they even preceded the Canadian Geological Survey.

"The region may become one of the great copper producers of the world. It is now still inaccessible; but the easternmost exposure of these rocks, so far as known, is not more than 500 mi. distant from navigable water in Hudson Bay, over a possible railroad route. And a railroad from the south is already projected to within 800 mi. of their most westerly exposure. As far back as 1845 Alexander Simpson anticipated that 'it is possible that ere this century has passed, an organized system of internal communication such as that which traverses northern Asia may place this valuable natural deposit within the reach of commerce.' He was too sanguine. The climate is severe. But so is that of Lake Superior; and for about 25 years after the native copper mines of Michigan were first opened, they were shut off from the east by ice, from steam communication, for almost half the year.

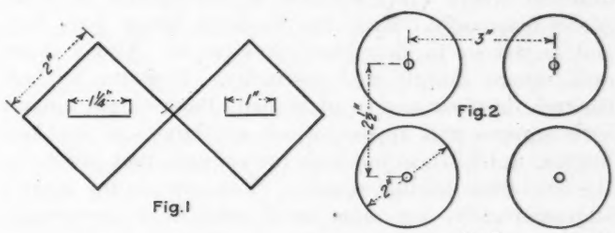
"As to fuel, lignite is plentiful within the Arctic circle, and our explorers brought samples from a large bed of it which crops out on the shores of the Great Bear Lake. If copper ores therefore exist in large quantities and are of a profitable grade, the unfavorable conditions are not sufficiently prohibitive to prevent their being exploited. And the race has happily not yet become so effeminate that men cannot be found willing to exchange the luxuries of civilization for the novelties and adventures of work in the wilderness, when the inducement is added of winning from Nature the treasures she has hidden away in such inhospitable regions."

## Cultivating Stereoscopic Sight

By Walter M. Brodie*

The study of crystallography is made easier and more interesting by having before one the actual crystals or, if these are not obtainable, representations or models of the various forms. To the expert crystallographist it may suffice to have a special facet described by a conventional sign, but the casual observer or amateur is far more impressed by actually seeing the occurrence, either on the crystal or on a model.

Crystals and models may be found in public or private collections, but as they cannot be carried around by students, it was suggested at one time that the various forms might be shown stereoscopically, and years ago, when stereoscopic views were in fashion a book was published giving such views of crystals. Other books may have been published later, but the use of an instrument was an objection, and I do not believe that the attempt received much attention from students, notwithstanding




FIGURES TO BE ENLARGED TO DIMENSIONS SHOWN

the clear manner in which it showed the subject. It was not generally known that a stereoscopic picture can be easily seen without any instrument.

To do so easily and quickly it may be well to remember the following: When we look at an object with both eyes, we see a single and distinct image, but everything nearer and everything farther off we see double and therefore indistinctly. To see things distinctly at various distances, we have to change the focus of our sight, and this accommodation, or change of focus, produces on us, through habit, an impression of the distance. But this is not the only way in which we unconsciously estimate distance. Near-by objects we see clearly and of a certain size; far-off objects we see hazily and smaller. In a clear atmosphere distant objects appear much nearer than on dark or moist days.

A stereoscopic picture is supposed to show the object as it is seen with the right eye of the observer and another view as it is seen with the left eye, and by making the

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two pictures cover each other approximately, either by means of prismatic glasses or in any other way, the effect of perspective is procured by our own involuntary effort. The true perspective effect theoretically requires two pictures similar to those seen by each of our eyes, which, if seen together, would require a certain change of focus from foreground to background, the same as we are accustomed to use.

It is, however, not always necessary to give exactly what our sight is accustomed to. Most stereoscopic pictures are not made that carefully. If we can impose on our sight and give it a picture where it is not accustomed to see it, the impression on our brain is altered and we give more attention to the impressions that are not interfered with.

If we hold a pencil up vertically, say 15 in. from our face, and look beyond it at a distant object, we see the pencil double. If we hold up a stereoscopic picture, prepared for the stereoscope, and look at the far distance, we see each of the two pictures double, and by accommodating our sight we can make the two inner images cover each other. As soon as this happens we see the middle picture stereoscopically, the same as we would in the stereoscope.

### The Acquisition of Stereoscopic Sight through Practice

Some people have great facility of accommodation of sight and others have not, but with a little practice such accommodation is easily acquired, as we all constantly use it unconsciously.

An easy way to acquire this facility quickly is to look at a piece of floor linoleum divided in squares of two different colors. A good size of the squares is 3 in. across diagonally. Have the linoleum before your feet, and as you sit in your chair, stare at it. You will see each square sharply and distinctly. Now try to look through the floor at a point beyond. Between the squares little squares will appear, which get larger as you look farther, until, when you look far enough, they get to be the size of the original squares. You now see the squares stereoscopically, the same as if seen in a stereoscope. Hold your vision there, and you will soon see the linoleum squares plainly at a certain distance below the floor and apparently larger. A white mark or spot on one of the black squares will be seen on two of the squares in the image, which, if you move your head sidewise, will also move, but in the opposite direction. You can do the same with Fig. 1, but the different colors and the number of squares on the linoleum make the process easier.[1]

Now observe this: Your eyes are only 2½ or 2⅝ in. apart. The squares are 3 in. apart from center to center. You therefore do not converge your sight on one point. You look with one eye at one square and with the other eye at the next square and the impression of distance is given by the unusual position of the eyes. Turn the linoleum around 45°, so as to get the black and the white squares parallel to your eyes. Look again far beyond the floor, and though the distance between centers of similar squares is more than 4 in., you will in a short time be able to get the two images to cover each other and you will see the linoleum squares still larger and still farther away than you did when their centers in the plane of your eyes were 3 in. apart.

While looking at a stereoscopic picture this way or through a stereoscope, we are unconsciously aware that the distance at which we see the picture is wrong and are therefore strongly impressed by the other things which produce the idea of distance, such as the sizes of objects in foreground and background, shadows, dimness of focus, etc. Therefore two exactly similar pictures placed side by side, looked at steroscopically, will give some impression of perspective, but to get good stereoscopic pictures of the forms in which crystals occur, it is necessary to have the two pictures properly drawn.

While sitting in your chair, looking at the linoleum in its first position, or at Fig. 1 on the floor, try the following: Hold your pencil about the height of your knees and you will see it double. Move it a little nearer or farther until the two images are as far apart as two similar squares are from center to center on the linoleum or on the figure you are looking at. Now look at your pencil. You will see the squares of the linoleum at the point where the lines of vision of your eyes cross as if painted on glass, and you will have no trouble in making the image stay there. The squares you see will appear much smaller than they really are. You again see stereoscopically, and if you look at a double picture prepared for this stereoscopic way of looking, you will get good perspective effect.

### The Application of Stereoscopic Sight to Crystallography

If, looking at the linoleum, you hold your pencil closer to your face, so as to make its double image cover the first and third similar squares instead of the first and second, you will, when you look at your pencil, be able to see a new image of the linoleum, smaller and nearer to you. Looking still nearer—that is, looking still more cross-eyed—you will see another and still smaller image. You can, if you stand far enough off, get a near-by image looking at wall paper or at anything where shapes or forms are reproduced in the same plane in which your eyes are situated.

Good stereoscopic pictures of crystals give satisfactory impressions, and if students were shown how to see such pictures properly without any instrument, the pictorial description of crystallography and of several other studies could be made much more interesting. Very little exercise is needed to make one an expert at seeing stereoscopically.

Look at Figs. 2 and 3, drawn according to the indicated dimensions, stereoscopially. First look at the far distance and see the dot in the upper circle nearer to you than the circle, the dot in the lower circle farther away. Change your view a few times from Fig. 2 to Fig. 3 and back again. Observe the effect. Now look for the near-by image and see the dot in the upper circle farther away and the dot in the lower circle nearer to you than the circle itself—the opposite of the first stereoscopic view. Now look again at Fig. 1 and notice the position of the line in the square when looking at the farsighted image and also its reversed position when looking at the nearsighted image.

If a reader has followed thus far, there is no doubt that he will ever after remain interested in the stereoscopic way of seeing things pictured or described.

[1] In carrying out the experiments referred to, it will be necessary for the reader to reproduce the accompanying figures to full scale in order to have the objects appear in correct proportion.

# Safety for Hoist Engineers

By Harry E. Scott*

In the last few years much has been done in the name of safety first. The Bureau of Mines has circulated many bulletins; mining and scientific journals have published articles covering almost every stage of the game; nearly all the mining companies have taken up the work, with wonderful results in lowering the percentage of accidents; but there is one that has been overlooked by almost all of them, and that is the hoist engineer. Many accidents are caused by the carelessness of the engineer that could have been avoided by taking the proper precautions. The men on the larger hoists have obtained their experience and been tried out on small hoists, and as a rule can be relied on to keep their heads in case of an emergency.

On the small hoist the engineer is often a young fellow who has taken a course in running a car on top, then a post-graduate course in dumping buckets. He learns the different levers and becomes the engineer. While he is not running the bucket or cage up and down the shaft for practice, he is rolling another "pill" or has a very interesting novel which he may be able to finish in that shift if he does not lose too much time. He is brought to his senses by the shooting signal. He knows everything is all right, so he answers it without looking at anything to see if he is ready to hoist when the time comes—still having his book in his hand.

### The Novel-Reading Hoist Engineer

A case of the novel-reading engineer came to my notice about two years ago. The shaft was down nearly 300 ft. and drillmen had their round in and loaded. They gave the shooting signal, and it was answered by raising and lowering the buckets. The three men who were in the shaft spit their holes, 16 in number, got on the bucket and gave the signal to hoist. The bucket, went up about 8 ft. and stopped; the men heard the engineer's voice at the collar of the shaft and knew that something had gone wrong; two made the timbers and got up far enough to be safe, but the other man dropped back to pull the fuses. He got five of them but the other eleven went off, and of course he was killed.

At the inquest the man who was running the engine (a 50-hp. gasoline) said that he was reading a novel when they gave the signal and that he answered it without speeding up the engine, taking a chance that it would speed when he was ready for it; when the bell came to hoist, he dropped the book, grabbed the levers and threw in the clutch. The engine stopped before it got the gas, with the men so far away from the timbers that one of them could not make it. It was not the fault of the engineer that there was no chain ladder in the shaft, but it was his fault that the engine failed to do its work.

Another instance occurred in the same camp about five months later, and although no one was injured, it was simply a case of fool luck that three men were not killed. This shows the most dangerous class of men on a hoist, from the miners' viewpoint, to be inexperienced men who can sit at the hoist and tell everything that is going on down the shaft when all they should know is what the bell tells them. In this shaft they are running two small drills with one man on each; the third man looked after the steel, powder, water, etc. The round had been drilled, the tools sent to the surface, the holes loaded and the men were ready to shoot the round. It was the custom for the third man to give the shooting signal. This day one of the drillmen asked him if he had given the bells, and he answered that he had, so the fuses were spit and they got on the bucket and gave the one-bell to hoist, which was proper. The bucket went up about a foot and down again. They gave another bell, and the same thing happened a second and a third time, so they took to the ladders and started for the top as fast as they could and succeeded in getting up far enough to be safe before any of the shots went off, and no one was injured.

On arriving at the top they found a very much excited man. When asked why he did not pull them out, he answered that he did not get any shooting signal, and as he knew they were ready to shoot he would not pull the bucket up on one bell when they were blasting. The man who said that he had given the signal admitted that he "guessed" he had not done so, but that did not excuse the engineer. One bell was the hoisting signal, and he should have hoisted, but he was one of the wise ones who know more about what is going on down in the shaft than the men who are there.

One of these hoistmen was a relative of the superintendent, the other a relative of one of the large stockholders. The management tried to keep them on the job, but the miners in the district decided that they should not run hoists any more, and they at last gave up the notion of being hoistmen and tried something else they could handle better.

It would be difficult to suggest a remedy for such cases as these, as long as the laws allow the use of this kind of men on hoists. Some of the states have statutes that are supposed to protect the miner against men of this character, but the law is not enforced if the applicant for a license has the *pull*. Even the *price* suffices with some of the officials. In the state where these accidents happened, an engineer had to have a license to run a hoist. The two men, who knew nothing about engines and had never had hold of a lever, were taken to the proper officials by the superintendent of the mine and got licenses without an examination, all that was required of them being to "dig up" a five-dollar bill.

### Advantage of Universal Code of Signals

There is one thing that will help the engineer and also the miner; namely, a universal code of signals, so that when he learns it on one job he will not have to learn a new code on the next one. This could be assisted greatly if the mining men of the country and the mining journals would take it up. Nearly all the states have different codes and some have none—each camp having a different system.

The following are a few suggestions for the new engineer, provided he is not already too wise to take them on: Keep a cool head; always use judgment and play safe; do not move the cage too soon after receiving the signal; look over your engine the first thing you do when you go on shift and be sure that all nuts are tight and the brake is in good condition; remember that you know nothing about what is going on down the shaft, so do as the bell tells you, and then if a mistake is made it is the other fellow's fault.

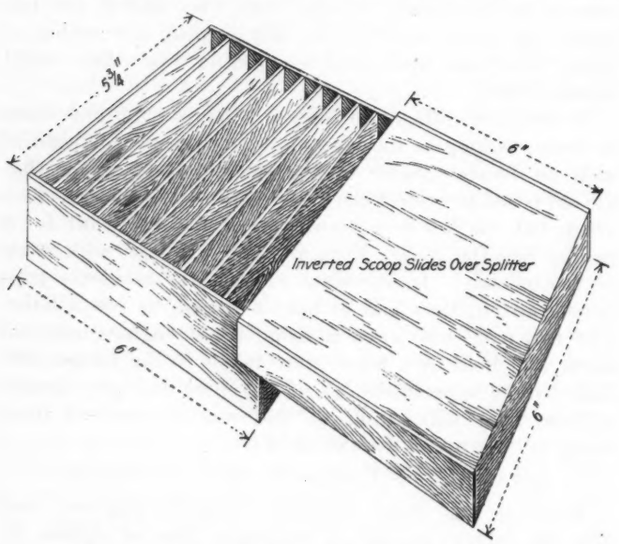
Although it may be hard on the engineer, it is noticeable that companies that have the "No Admittance" sign over the door and enforce it have fewer accidents than those that allow visitors in the engine room.

*Mining engineer, Johnson, Ariz.

# Details of Practical Mining

## A Compact Sample Splitter

In examining mines and prospects in out-of-the-way places many implements that would be of great convenience or are almost indispensable to the engineer are left behind because they take up too much room. Among these may be mentioned the sample splitter. This is a sampling tool that in its usual form of construction is awkward to pack and is therefore often not carried. If no splitter is found where the samples are cut and broken down, mixing on a canvas and quartering must be resorted to. The advantages in always having sampling riffles, both for convenience and accuracy in cutting down samples, are so great that the riffles shown in the accompanying illustration were designed. Only two changes were made over the ordinary form. The inside length of the riffles was cut down from 6 in. to 5¾ in. so that the outside length, when taking into consideration the wire reinforcement always around the edges, would be slightly less than the inside width of the scoop, permitting the latter to be slipped over the riffles. It is obviously necessary to shorten the length of the riffles to permit them and the scoop to be fitted together, as the width of the riffles and scoop must be the same. Thus, by leaving the handle off the scoop, an unnecessary adjunct anyway, we have a set of sampling riffles that take up less than one-half the space of those of the ordinary construction and hence are much more convenient to transport. The riffles shown are 6 in. wide, making an exceptionally compact set. They could be made any size on the same plan and be far more compact than those of the usual construction. Portable equipment is becoming more and more popular and many appliances are available in portable form which a short time ago were impossible to take along on account of the size or weight. It is hoped that in the future additional equipment will be developed in portable form.




A COMPACT AND PORTABLE SAMPLE SPLITTER

## Bell and Buzzer Signal System

By Albert E. Hall* and George McFeely

Various kinds of signals are in use at mines, ranging from the old lever with its wire running to the power house to the modern electric system. The system here described is in use at the Creighton mine, Ontario, Canada, and has proved satisfactory. It may appear complicated, but when in operation works smoothly and causes no loss of time.

Each level is provided with a bell and pull for each hoisting compartment in the shaft, and there is a corresponding set of bells in the hoisthouse. When the signal is given, the bell rings not only in the hoisthouse, but also on every level in the mine, so that observers at any of the stations are informed as to the movements of the skip or cage. Thus the chances of a man's being hurt by sticking his head into the shaft or climbing on the track are reduced to a minimum. The hoistman also has a set of push-buttons placed conveniently on his working platform, and he repeats every signal given before he moves the skip or cage. This is a further safeguard against accident as it insures a thorough comprehension of the signal. On each level and also on the surface, but not in the hoisthouse, a buzzer with a pull is placed, and this is used as a call.

The wiring for the system is shown in the accompanying illustration. A large cable containing 12 wires extends down the shaft. Only the six wires connected with the bell signal system are shown in the diagram. Other wires are used for the telephone, powder signals, etc., the bell system is usually operated by electric current from the main power line, but when the alternating-current power is off, the system is operated by current from a storage battery. When a signal is given at a pull-switch in any compartment, all the bells in that compartment ring. The single-stroke type of bell is used, and this system can be used with any number of compartments.

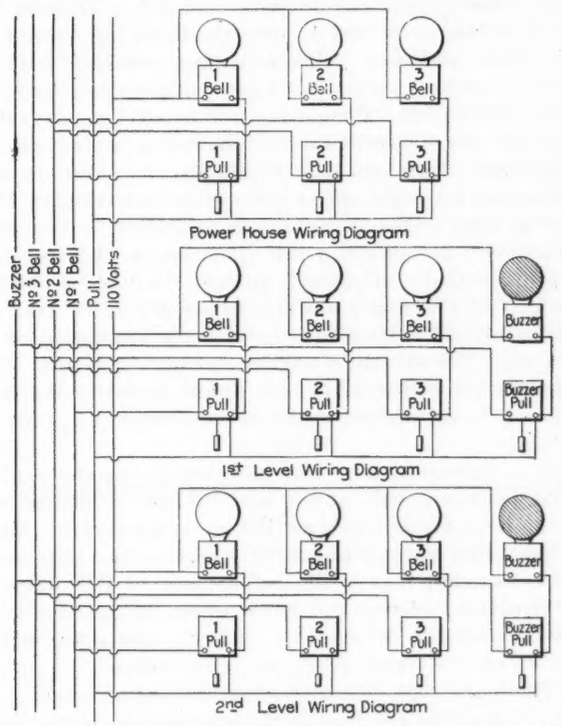
The signals used are as follows: 1 bell—stop if in motion, hoist if at rest; 2 bells—lower; 3 bells—men about to enter cage; 3 bells in return—men may enter cage; 4-1 bells—hoist slowly; 4-2 bells—lower slowly; 9 bells—danger signal; 5 bells—release cage (hoistman can move cage to any place he desires); 6 bells—ore; 7 bells—waste.

The signals for the levels are as follows: 4-4 bells—surface; 4-5 bells—first level; 4-6 bells—second level; 4-7 bells—third level; 4-8 bells—fourth level; 5-4 bells—fifth level; 5-5 bells—sixth level; 5-6 bells—seventh level; 5-7 bells—eighth level; 5-8 bells—ninth level; 6-4 bells—tenth level; 6-5 bells—eleventh level; 6-6 bells—twelfth level; 6-7 bells—thirteenth level; 6-8 bells—fourteenth level; 7-4 bells—fifteenth level; 7-5 bells—sixteenth level; 7-6 bells—seventeenth level; 7-7 bells—eighteenth level; 7-8 bells—nineteenth level; 8-4 bells—twentieth level;

*Superintendent, Sable River Copper Co., Massey, Ontario, Canada.

8-5 bells—twenty-first level; 8-6 bells—twenty-second level; 8-7 bells—twenty-third level; 8-8 bells—twenty-fourth level.

To show the operation of the bell system, let us suppose that the timber skip is hooked below the cage and is at the surface. When it has been loaded and ready to lower, the 4-2 signal is given and the hoistman returns the signal. After this he lowers the cage until he gets 1 bell, which will be when the cage reaches the surface landing, and the hoistman stops the cage. The cageman then rings 3 bells and the hoistman returns the signal, whereupon the cageman may enter the cage. Let us suppose the cage is to go to the sixth level. The surface lander will then ring 5-5 bells and the hoistman will return the signal, after which the lander will give 2 bells and the hoistman return 2 bells and lower the cage to the sixth level. When the cage reaches the level, the cageman gets out and rings 4-1 bells and the hoistman returns the signal and hoists slowly. When the timber skip reaches the level, the cageman rings 1 bell and the hoistman stops the cage and returns the signal, whereupon the skip can be unloaded. This seems a long process, but in fact is very satisfactory after it has been in use for a short time. In the described movement of cage and skip, 56 bells had to be rung, but the operation is not as long as it sounds.




WIRING DIAGRAM FOR A BELL-AND-BUZZER SIGNAL SYSTEM

The skips run in counterbalance. The skip tender rings 6 or 7 bells, depending on whether he is going to hoist ore or rock. The hoistman returns this signal, and the lander at the surface fixes the proper dump and returns the signal. The skip tender then rings 1 bell to hoist, and the hoistman returns the signal and hoists the skip. From then on only the 1-bell signal is given to hoist, but the hoistman always returns the signal.

The bells are all set on the post of the station timber to the right of the compartment for which they operate, so that no mistakes will be made by pulling the wrong bell. The buzzer is set in the wall of the station back a short distance from the shaft. If the cage is desired at a level, the level signal is given on the buzzer and the cageman proceeds to the level when convenient. In the event that the cage cannot be sent at once, the cageman signals on the buzzer to inform the one calling that he has been heard. There is no buzzer in the hoisthouse, so that calls on the buzzer do not disturb or confuse the hoistman.

## Economy of Solid-Woven Belts*

By W. F. Schaphorst†

On account of the high cost of leather at present, the price of leather belting is becoming almost prohibitive. Leather is a good medium for conducting power. It has established efficiency records as high as 98% in actual tests; it is strong, tough, elastic; it can be made into endless belts with comparative ease; and it is especially good on drives where the belt must be shifted back and forth often from pulley to pulley. But in spite of these good features, leather belting has its faults. It is always stretching and unless properly cared for is affected by moisture, heat and cold. It cracks and grows hard and stiff on drying. There is no good reason, therefore, why users should not look to some other source for belting and if possible get a less costly and better belt.

The solid-woven belt is rapidly coming into prominence as the solution of the problem for the user and buyer. Consider for a moment the economies of this new entry into the belting field.

In the first place, most users have not bought belts correctly. Much money could have been saved on leather belts by selecting the most economical combination of belt and pulleys. Too many belt men and belt-drive designers have been in the habit of sizing up a machine with the eye and concluding offhand that a certain pulley will answer the purpose. Such a conclusion is no more than a guess, but the pulley is installed and thereafter the belt man may or may not have trouble.

Pulleys must not be too small, because small ones are liable to slip easily; and they must not be too large, because large pulleys are expensive. Both belt and pulley must be just right. A small pulley requires a wide belt—at least a wider one than a large pulley transmitting the same power and running at the same speed. Large pulleys, therefore, can be run with comparatively narrow belts. Fig. 1 shows a belt on small pulleys, the distance between pulleys being 30 ft. This drive costs more than the one shown in Fig. 2, although in the latter we have pulleys twice as large as those shown in Fig. 1. In Fig. 1 the belt costs too much. It is too wide and heavy. In Fig. 2 the belt costs one-half as much because it is just half as wide as that in Fig. 1. It is now plain that something is required of the user in making the selection of belts and pulleys. A little figuring must be done in order to sift the whole thing to the most economic size.

First, do just what is usually done—make a guess at the size of the smallest pulley. That is, what do you think the diameter should be? To guess intelligently, the speed of the small pulley must be known. If it is a

*Copyright, 1916, by W. F. Schaphorst.

†Mechanical engineer, Woolworth Building, New York.

pulley on a motor, how many revolutions per minute does the motor make? Also, how many revolutions must the driven pulley make? The diameters of the pulleys will be inversely proportional to these speeds; that is, a 1-ft. pulley of a given drive would make 4,000 r.p.m. if the 4-ft. pulley to which it is belted makes 1,000 r.p.m. Choose pulleys of such size that the speed of the belt will not be greater than a mile a minute. Steel pulleys may be safely run at 6,000 ft. per min. peripheral speed. You are now ready to compute the width of the belt, which is easily done for leather belts as follows: A single leather belt 1 in. wide running 800 ft. per min. will transmit 1 hp. And for other thicknesses use 500, 400 and 300 respectively for 2-ply, 3-ply and 4-ply.

For solid-woven belting a prominent manufacturer gives the following rules: Single is equal to single leather; light double is equal to extra-heavy single or light double leather; regular double is equal to double leather; triple is equal to triple leather. This, before passing into the next phase of the subject, is a very good showing for woven belting. The rules are about equally applicable to either leather or solid-woven belting.

Now, knowing the belt width, you can easily decide on a pulley width. Generally the pulley is about an inch

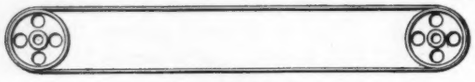


FIG. 1

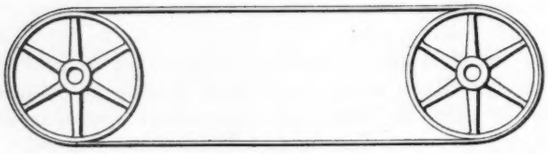


FIG. 2

FIGURES SHOWING THE RELATION BETWEEN PULLEY DIAMETER AND BELT LENGTHS

wider than the belt. It does no harm, to be sure, to use pulleys of even greater width, but never use those that are narrower than the belt. Once in a while one sees such drives, but they should never be tolerated.

Next find the total cost of the belt and pulleys. In order to do that the length of the belt must be known. To find this, multiply the diameter of the small pulley by 1.57; multiply the diameter of the large pulley by 1.57 also; multiply the distance between shaft centers by two; and then add all these products together. The sum will give the belt length closely enough for most computations, although it is not always absolutely accurate.

Everything is now known, except prices. These are given in transmission catalogs or must be obtained specially from the manufacturer if of a fluctuating nature. Next choose a larger diameter for the small pulley and do the computing all over again. Perhaps the total cost of larger pulleys and a narrower belt will be less, perhaps more. It is impossible to tell until one figures it. If the cost is less, try a still larger diameter for the small pulley, always remaining within the allowable belt speed.

If the cost is more, in either of the trials, choose a smaller pulley and try again. It is wise, generally to tabulate the results systematically for the avoidance of errors. Such a tabulation should include the following items: (a) Diameter of pulleys, (b) width of belt, (c) width of pulleys, (d) length of belt, (e) cost of pulleys, (f) cost of belt in dollars, (g) total cost, dollars. This tabulation will tell the whole story in condensed form. The final column, "Total cost, dollars," is the important one. The least total cost generally is the most economical where the distance between shaft centers is 20 or 30 ft.; but where pulleys are close together, judgment must be used in addition to figures. Usually, this method gives amply large pulleys—larger, in fact, than one would use on guessing the diameter, but large pulleys are generally best.

This applies equally to leather and to solid-woven belting, but on account of the much lower cost of the latter it is plain that it has an even greater advantage where the distance between shaft centers is great. At any distance, though, woven-belt drives cost less. To show this great difference in cost I quote the following from a letter in my possession: "Recently, on a new installation in a big East End plant, they figured leather belting would cost them $3,500. Comparing cost of solid-woven belting for the same installation, it showed a saving of just $2,218.40. Ours cost only $1,281.60, and additions were such that we could guarantee our belting to give them just as good service as best grade of leather." This manufacturer will not sell a belt if he knows finger shifters are to be used. "Usually," he says, "the belt is blamed instead of the finger shifters, when the belts wear out prematurely." His idea is to save the reputation of his belting. The old finger shifter should be tabooed. It is hard on any belt to allow it to scrape against a sharp object. A broad surface should be used to press against the belt.

It is claimed by some belt men that they cannot make a good joint in a solid-woven belt, but that is because they go at it in the wrong way. Being accustomed to leather belting, they are inclined to try to join woven belts in the same way, but that is illogical because of the difference in structure. Some of the new metal lacings and joints do satisfactorily on solid-woven belts, and some makers are successfully making woven belts endless.

There are other advantages that accompany woven belting, such as less pressure on the bearings due to the larger pulleys and lessened tension; power is saved; bearings and babbitt are saved; there is less slip and less belt wear; and the goodness of the belt runs all the way to the output, which is increased and improved because of the absence of slip and the steadiness of the large pulleys and the all-around economical combination.

## Economy of Timber in Mining by Ohio Caving System

One advantage of the Ohio caving system, in use at the Ohio copper mine at Bingham, Utah, at the Inspiration copper mine in Arizona and elsewhere, is its extreme conservation of timber. Only enough timber is required to protect the men during the time of working instead of requiring permanent sets. After caving the timber is recovered by a grizzly and returned to the workings and used over again. At Ohio the cost of timber is about 1c. per ton of ore mined. No detailed estimates of Inspiration's costs are yet announced.

# Details of Milling and Smelting

## Limestone Precipitation of Weak Copper Solutions

Limestone precipitation of Inspiration's oxidized ores was mentioned briefly last week in the *Journal's* account of the A. I. M. E. meeting in Arizona, in connection with the proposed leaching of the Inspiration's low-grade carbonate and silicate ores. Rudolph Gahl in introductory remarks to his paper on the "History of the Flotation Process at Inspiration," referred to certain changes that had developed in the practice, since the writing of this paper. He stated that although the addition of hydrogen sulphide permitted a good recovery of copper carbonates with certain ores, it had not proved especially advantageous at Inspiration and that experiments with leaching had shown more satisfactory results on the carbonate and silicate ores. He added: "We intend to use limestone for precipitation of the copper that goes into solution, as electrolytic precipitation seems out of the question on account of the diluteness of the solutions; precipitation by iron was rightly objected to because of the unavoidable contamination of the water supply. We feel very hopeful about the success of our limestone precipitation, which, if it holds what it seems to promise, will develop into a novel feature of copper metallurgy."

## Finding Splinters in Fingers

Those who have to practice "first aid" in mines and reduction works will probably find the following of great help:

"Location in a busy clothing manufacturing district gave rise to the necessity for a simple method of determining the presence and location of foreign bodies, such as needles and splinters, in fingers," says Dr. Roscoe H. Webb, in the *Journal* of the American Medical Association. "A piece of black woolen cloth 8 in. square was fastened to a piece of adhesive plaster of equal size, and in the center an oval opening was made measuring five-eighths by one-half inch. By placing this over an electric light supplied with a reflector and placing the finger over the hole, excellent transillumination is obtained, and by making pressure with a pointed instrument over the suspected area, the object can be brought out more clearly. If the field is rendered bloodless while operating, the finger may be placed over the opening and the object can be again accurately located. This device is simple, inexpensive and indestructible. It is more easily adapted than pocket flashlights, etc., to the finger, and reduces to a minimum the number of cases requiring röntgenograms. Daily use for the last six months by several workers in the accident room has proved its efficiency."

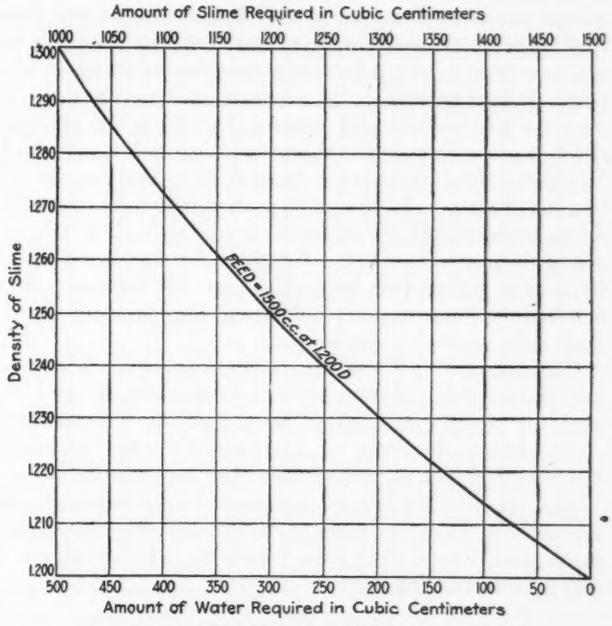
**Crucibles Often Fail** along the sides rather than on the bottom. The bottoms of a crucible in this condition may be removed and used as covers for other crucibles for several melts. Often the bottomless ring left above the point of failure can be used as a funnel through which charge can be fed into a crucible already in the fire.

## Chart for Flotation Testing

By L. B. Pringle*

When testing flotation oils, it is often necessary to have a feed of constant assay, volume and density. It is also sometimes essential to use a feed in the laboratory machine that is identical with the feed used in actual practice, so far as possible. Some of the difficulties I have encountered, and the remedies applied when testing oils, are herein described.

Having about one hundred oils to test out as to their frothing and selective qualities, as compared to the oil used in regular practice at the mill, I collected about 200 lb. of the feed to the flotation machines, dried it




FEED CHART FOR FLOTATION TESTING

and passed all through a 150-mesh screen. This was then thoroughly mixed, quartered and assayed. To compare the results of the mill machine with the laboratory machine (a Janney testing machine), I used the same oil that was being used in the mill, a charge of 500 grams and a volume of 1,500 c.c. I was greatly surprised to find that the results with the Janney were much lower than we were getting in actual practice. I then tried mixing feeds of various densities and used various amounts of oil, but in every case the concentrates were low and the tails high. I next tried drying more of the slimes at low temperatures, and again I got the same results. Adding a few drops of sulphuric acid lowered the tails but also lowered the grade of concentrates. This led to the conclusion that no matter how low the temperature was in drying, the galena and pyrite took on a film of oxide that interfered with the results when testing. The sul-

*Mining engineer, Bonne Terre, Mo.

phuric acid probably removed this film, also brought the calcium and magnesium carbonates to the top with the concentrates.

The mill slimes are mixed in Dorr tanks, and in one of the tanks I found the slimes to be free from old oil. Numerous assays and density determinations on these slimes showed the lead content to be practically constant, and the density to be from 1.250 to 1.280. Collecting some of the slimes and running them with the same oil as used before, I found my results from the Janney laboratory machine to check closely with those of the mill machine. Further experiments showed that a volume of 1,500 c.c. and a density of 1.2 gave the best feed for the Janney machine. As the density of the slimes from the Dorr tank was always above 1.2, but variable, I plotted a curve that showed the quantity of slime necessary at various densities and the amount of water needed, for a constant feed of 1,500 c.c. volume and density of 1.2. On several occasions afterward I needed to change the volume and density of the feed in making other tests, so I have derived a formula that may be applied to the original curve readings to determine the volumes of slimes and water needed for any other feed of a different volume and density. This curve and the accompanying formulas will be a great time saver to any experimenter meeting conditions similar to mine. The reduction formula may be used for any volume and density, providing the original slime density is not less than that required in the feed or greater than the curve is plotted for. Caution should be used, however, in the mixing of the final feed, as the solids settle rapidly in the slimes, and there is apt to be a loss in pouring, causing the final density to be lower than that calculated for. The use of large-mouthed bottles in mixing, rapid pouring and due care will eliminate this source of error.

The diagram and formulas will show the method used for plotting the curve, and the same method may be used for plotting any other curve that the experimenter should choose to adopt as a standard. (See equations 1, 2 and 4.) The reduction formula (see equation 3) explains itself. Numerous experiments have found the specific gravity of dry pulp in the slime herein mentioned to be 2.84 ($S$ in equations 1 and 2). In equations 1 and 2, $m$ is 463 grams.

### Curve Formulas

Let

$m$ = Weight of dry material in charge;
$V$ = Volume of charge, taken as 1,500 c.c.;
$W$ = Weight of a unit volume of water, taken as 1;
$S$ = Specific gravity of dry material (for slime, $S = 2.84$);
$P$ = Density of charge, taken as 1.2.

Then

$$m = \frac{VWS(P - 1)}{S - 1} \qquad (1)$$

To find points for curve,

Let

$d$ = Density of slime;
$Q$ = Amount of slime required to make the charge;
$V$-$Q$ = Amount of water required for charge;

Then

$$Q = \frac{m(S - 1)}{S(d - 1)} \qquad (2)$$

In this particular case $Q = \frac{300}{d - 1}$.

To find the amount of slime required to mix a feed of any other density and volume, from this curve, let

$v$ = Amount of slime required, as shown on curve, of any density "d";
$V_1$ = Volume of new charge;
$D_1$ = Density of new charge;
$Q_1$ = Amount of slime needed for the new charge;
$V_1$-$Q_1$ = Amount of water needed for the new charge;

Then

$$Q_1 = \frac{v(D_1 - 1)V_1}{(D - 1)V} \qquad (3)$$

In this particular case,

$$Q_1 = \frac{v(D_1 - 1)V_1}{300}$$

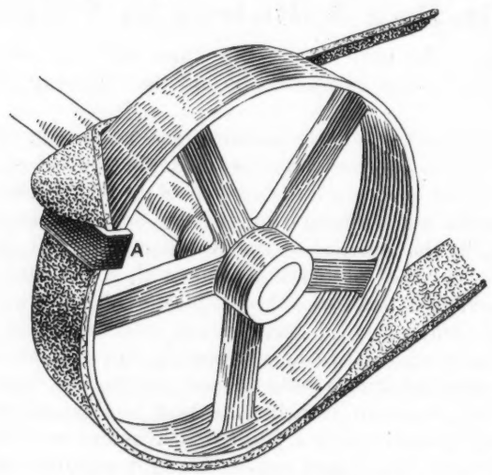
A general equation, eliminating $m$, for determining the amount of slime and water necessary for any charge, has been contributed by H. Rabling[1], and is as follows:

$$Q_1 = \frac{V_1(D_1 - 1)}{d - 1} \qquad (4)$$

## Placing Tight Belts on Pulleys

At a plant where a number of belts are used very tight and in consequence are difficult to place on their pulleys, the small device shown at $A$ in the illustration makes the task of placing a tight belt an easy one, according to A. E. Holaday, writing in the *American Machinist* for Oct. 19, 1916.

The device is made of ⅛ in. flat steel about 2 in. wide. It is bent at right-angles at the ends, the bends being made




REPLACER FOR TIGHT BELTS

so that the contrivance will fit the width of the pulley face. The ends are about 2 in. long. By starting the belt on the pulley and holding this angle iron over the belt, the belt can be run on without difficulty. To avoid accidents the belt should be run on either by hand or at a very slow speed.

**Pigs Are Prevented from Sticking** in their casting molds in the following manner. Before the molten metal is poured, slacked lime is introduced into the mold. The heat of the molten metal drives off the water from the lime and leaves a powder (CaO) which keeps the mold and the pig separated.

[1]Mining engineer, Bonne Terre, Mo.

# Revision of the Mining Law--II

The following communications were received by the Mining and Metallurgical Society of America in answer to its questionnaire on the points involved in the proposed revision of the mining law of the United States. Congress declined to appoint a commission to draft a new mining code and it is now up to the mining industry itself to crystallize its ideas as to what the new law should contain. Readers are invited to contribute their views on the points involved in the questionnaire, which was printed on p. 719 in the *Engineering and Mining Journal* of Oct. 14, 1916.

J. Parke Channing (Sept. 15, 1916)—In regard to the size of the claim my opinion is that it should be 40 acres; that is, 1,320 ft. by 1,320 ft. In this way we more nearly preserve the length of lode allowed in the present mining claim of 1,500 ft. and we simply give it extra width to allow for the abolition of the extra-lateral right. Iron-ore leases in Michigan, Minnesota and Wisconsin are seldom, if ever, made on less than 40-acre tract, unless there should be a fractional $\frac{1}{16}$ section which is not up to the full 40 acres. I am of the opinion that where a country has been sectionized, undoubtedly these claims should correspond with the 40-acre tracts of the sections. In unsurveyed territory I am doubtful as to whether the provision should be made that lines be north-south and east-west. In cases of veins striking northeast and southwest this would lead to a great deal of confusion.

In this connection it is interesting to note that when the eastern end of Tennessee was sectionized, it was apparently recognized that the trend of the country was northeast and southwest and the meridian was made to conform with the general topography of ridges and valleys of the country. Incidentally this very nearly agreed with the trend of the copper formation. I think undoubtedly the first locators in a district would approximately determine the trend of the mineralization, and in districts where the formation curved, later claims would be properly oriented.

This rule of square location should, however, not be made too rigid, but provision should be made that in a location only two of the angles need be right angles, thus permitting a want of parallelism on one side so that the claim might butt up against another and yet change its general direction to conform to the strike of the lode. I was lately looking over some claim maps of Cuba, in which country I understand all angles must be right angles. The result was that in butting up against an adjoining property the line looked like that of a saw, which of course is ridiculous.

I very much favor the principle of permitting an amount equal to the assessment work to be paid in cash rather than, as is often the case, allowing it to be frittered away without benefit to anyone.

Charles A. Chase (Sept. 14, 1916)—I have reviewed the proposed outline of a mining law as offered by the New York Section, together with the subsequent discussions, and my conclusions are:

1. The classification of public lands seems unimportant, it being well enough to permit the prospector to seek mineral where he will. Mr. Parker's discussion of this is pertinent.

2. To require a claim of 40 acres seems less satisfactory than to make that a maximum for one claim, leaving 10 acres as a permissible minimum; and instead of requiring a large square, permit as many as four 10-acre square units to be placed in a row, thus giving considerable latitude in shape and size of claim. Having this latitude, conformity with legal subdivisions would be less objectionable and even attractive in the surveyed areas; further in unsurveyed areas the exclusive use of north-and-south and east-and-west lines would facilitate subsequent reconcilement with the public survey on the occasion of the official survey for patent. I think it well worth while and practicable to avoid the infinite criss-crossing of claims.

3. Mr. Gardner's discussion shows the necessity of discovery at least antecedent to patent, if not to valid location. Permitting later discovery of mineral coupled with the requirement of full $100 worth of work each year beginning with initiation of claim, compulsory recording of each year's assessment and heavy penalties for fradulent affidavits might form a satisfactory procedure. The demand for record in the United States Land Office seems impracticable, these offices being in general too remote; such a record without the prior requirement of official survey (even in surveyed areas corroboration as to location is necessary) would be valueless, and worse, being dangerous in attempting to give something that it could not give without better machinery than has been suggested. Most locations originate through individual special knowledge of vacant ground, and that knowledge may be expected to be more accurate than a Land Office map based on inaccurate data.

4. If the claim may be varied from 10 acres to 40 acres, $100 is a reasonable average annual assessment. An actual cash payment 50% larger in lieu of work on the ground has much to commend it and, if this might be divided between county and national governments, might be acceptable to the Western public.

5. The crediting of large expenditures in one year to subsequent years seems fundamentally bad.

6. I see no sufficient reason for limiting possessory ownership by requiring patent. If the affidavit of annual labor is made compulsory, the possessory title permits simpler return to the public domain.

In general, there seems no sufficient reason why any patent, whether placer or lode, should not be secure from attack after a few years and be expressly made so in a new general law.

Court review of Land Office decisions should be made readily available.

In making these comments I have presupposed vertical boundaries subject only to existing extralateral rights. Previously offered current contributions have been useful to me in clarifying my own ideas.

Frank A. Ross[1] (Sept. 4, 1916)—Actual discovery of a valuable mineral deposit should be necessary to a final and valid location of a claim, but the new law should authorize preliminary locations without discovery and should protect the prior locator in his rights as long as he prosecutes a continuous and diligent search for mineral. This is to prevent trouble between two or more

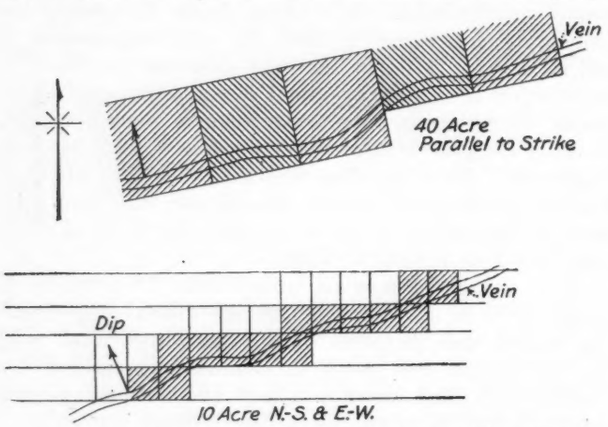
[1]Nonmember.

locators on suspected ground, each striving to find mineral first. But all preliminary rights should determine upon cessation of work and title should revert to the Government.

It is a moot question whether claims should be 660 ft. square or 1,320 ft. On surveyed land and in rare cases where veins strike due north-south or east-west, the 10-acre claims would offer certain advantages perhaps, but on unsurveyed lands and where the veins strike in any other directions than N-S and E-W it would be very difficult to locate them by staggered 10-acre claims, bounded by N-S and E-W lines, so as to cover enough of the vein on its dip to make the claim valuable. Other 10-acre claims would need to be located in the direction of the dip to protect the first location. See accompanying sketch.

On the other hand, if 1,320 ft. square were adopted and the claim might be staked out with one side parallel to the strike (where there is an outcrop) and as close thereto as possible, then the rest of the claim on the dip side would give ownership to a satisfactory depth of vein even without supplementary locations in direction of the dip.

Consequently I am strongly inclined to believe that claims 1,320 ft. square located according to the judgment of the locator and not confined to political divisions and subdivisions of surveyed lands or to north- and south, east-and-west lines on unsurveyed lands, will work better in practice and give more satisfaction all around, regardless of the crazy-quilt pattern of the camp map.




STAGGERED CLAIMS WITH N-S AND E-W LINES

Very few surveys of our mountainous districts are found to be correct, so that fractions are almost bound to exist in any event and must be covered. Again, on unsurveyed lands it would certainly bother any prospector to set out north-south or east-west lines that would hold on survey and he would find such a requirement very obnoxious, I think. The labor of staking claims in heavily timbered districts, for instance, is far greater than most persons imagine, and few lines are ever correctly run at first.

The number of claims locatable by one person or association should be unlimited, but assessment work or equivalent cash payments should be strictly enforced; failure to comply should work forfeiture of rights, and claims should be so posted or at least the records should be so marked as to serve as notice to the public. Present regulations as to marking notices and records of location should be amplified so as to enable the public to trace immediately the ownership of any ground that has been staked. For instance, present monuments are not sufficiently permanent and the same applies to the posted notices of location. Serial numbers should be given to each claim by the recorder, one series for preliminary notices of location and another for permanent; and these numbers should be carved or painted upon the monuments together with the office in which recorded. Preliminary notices should be filed within 30 days—the sooner the better.

If it is desirable to file any notice in the local United States Land Office, then six months after striking valuable deposits should be sufficient. But all notices should be filed at the county seat.

Annual assessment work should be at the rate of $5 per acre, but the payment of an equivalent amount of cash should be permitted in lieu of actual work for a period not to exceed two consecutive years upon a sworn statement of good faith and intention to perform the actual work in future. This would serve to tide over a short period of hard luck, but would prevent the holding of claims unworked and undeveloped. Actual work should be required under heavy penalty. Affidavits of same should be made and filed with the recorder annually. Failure to do so should work forfeit within a certain time, say 60 days after Nov. 1; in other words, before Jan. 1 of each year. The recorder should keep a proper record of each claim filed, showing assessments or lapses, etc. ("Recorder" means "county recorder.")

Owners should be permitted (by all means) to hold a group by doing work on one claim, provided that this work is development for the group and provided that the total expense of this work is equal to the number of acres in the said group multiplied by $5, all labor to be reckoned at current wages of the district. Sums expended in excess of the required amount for either single claims or groups should be credited upon the work of the following year or years and should be allowed in applications for patent, provided that no fractions of $200 be allowed if claims comprise 40 acres.

Filing in a United States Land Office is not necessary as regards preliminary or final notices of location, though there would be no objection to filing the latter if desirable for any reason. Present patent procedure seems to be reasonably satisfactory on the whole with the exception of scrutiny by land-office officials that are not conversant with mining methods and requirements. United States mineral surveyors have some improvements to suggest, I believe.

I see no objection to the seven-year limit, for the reason that valuable claims are certain to be patented before that time.

By all means provide for appeal from the decisions of the General Land Office.

L. K. Armstrong[2] (Sept. 7, 1916)—Referring to the amount of labor to be expended annually, I am opposed to the $200 requirement, as unpatented claims are usually in the hands of poor people and in the withdrawal of extralateral rights the 40-acre claim as a rule will carry no more vein value than 20 acres without abridgment of these rights.

Referring to notice of location and compulsory final entry. I am opposed to limited time for final entry

[2]Spokane, Wash. (nonmember.)

and payment for land with penalty of forfeiture, for this would work a hardship on the claim owner. Patented land is a deterrent to development and so the making of mines, and will sooner result in consolidation of large interests.

It is my observation, applied in many cases here, that land once patented is land idle. It is palpably unfair to ask that mineral lands be continuously developed after patent issues, without questioning the legality of such demand. It would seem to be wise to let this provision of the law stand; demand continuous annual assessment, as now, until patent issues without limiting time for this.

Frank A. Ross (Sept. 18, 1916)—I fully agree that, theoretically at least, mining locations made in conformity with meridional lines might somewhat simplify descriptions in certain instances; but I am equally convinced that the net practical result of such a requirement would be to increase greatly the difficulties of location and, quite probably, to create more or less confusion. Again, much more ground would need to be covered than if locations were made parallel to the known or supposed strike of veins. I shall briefly outline my objections, all of which are based upon practical experience with conditions as they are and not as they are supposed to be by some of our lawmakers. And I wish to preface my remarks with a declaration that staking claims is not the simple process that many imagine it to be. Out in the open, rolling country—yes; but in all mountainous regions, broken up, heavily timbered and brushed and mostly precipitous, the work of running claim lines is almost always severe. Professional men know this, but few laymen do. Therefore my objections to the meridional system are these:

In the first place, immense areas of mineral-bearing ground are still unsurveyed and will so remain, perhaps, indefinitely.

Second, a surprisingly large percentage of completed surveys are what is known as "office surveys"; that is, surveys by contract in which the Government has been outrageously cheated by the contractors. For instance, I once employed a surveyor to plat a group of claims in the Cascades, in a district that had been surveyed. Imagine my amazement when he told me as a great joke (!) on himself that, not being able to find the section corners, he had bought one of his own maps, made some years before and forgotten until then, because, as he said, "I didn't remember that that district was among those that came under my contract. Why! I never left my office when I made that survey!" Good joke, was it not? I have since been informed that such instances were by no means rare.

Third, in an astonishing number of cases where surveys have been run, no permanent monuments were erected, and it becomes a heartbreaking task to locate corners in any instance, but particularly in badly broken, timbered and heavily brushed districts; and prospectors, when about to locate, are quite shy about calling outsiders into a consultation. I was examining a property a few weeks ago and had occasion to trace certain section corners in the Bitter Roots, Montana. It took me and my assistant two whole days to find two corners. They were marked by flat stones, lying loosely on timbered talus slopes and chiseled so faintly that only through pure luck did my agile assistant tumble on to them. How on earth can one expect prospectors—strangers to the district, perhaps—to conform to meridional lines, or even to approximate them, under circumstances like these? And how many prospectors would do so? They can all strike bee-lines in any directions they may wish to go, but few carry compasses or known how to use them in coursing.

Fourth, when mineral is discovered it is of vital importance to stake the ground in the shortest possible time. If the discoverer is permitted to take the formation as his guide—down gulches or cañons and up again, through timber, brush and fallen rock—his work of locating is as easy as it can be made for him; but if he must first orient himself; or hunt for section corners, then I seriously doubt if he will do it; or, if he does, he will everlastingly "cuss-out" the Government that made such fool laws. Furthermore, if it happens that other men are frantically staking all around him, I can see several different kinds of confusion, disputes and even warlike acts, both before and after meridional surveys are made, particularly in an unsurveyed district. Beyond all doubt, many would lose valuable portions of their veins where the strikes of the latter were in directions other than toward the four cardinal points. But this could not happen if claims were staked parallel to the strike and if the monuments of the first line run indicated on which side the remainder of the claim was to lie.

Fifth, I claim that if vertical planes limit ownership, then there is positively no objection to the so-called crisscross locations. Permanent mineral monuments are easily established to which all claim corners may be tied; and these monuments themselves may be tied to section corners if anything is to be gained thereby, as in the making of a general map; etc. No confusion ever has arisen that could not also arise under the meridional system. In every stampede, claim lines always overlap each other and always will. Adjustments must follow, and there is no practical remedy for this condition.

The crux of the whole matter, to my mind, is the enforced establishment of permanent corner monuments together with the destruction of all obsolete monuments by the official mineral surveyor after he has noted their exact locations in his records.

Today our mining regions bristle with decrepit corner posts on lapsed claims that merely serve to libel the ground or to act as bases of blackmail suits.

Whether or not the claims comprise 10 or 40 acres is, I think, immaterial, although the suggestion to stake only a 40 where four claims are taken up is to the point as a compromise.

## Workmen's Compensation Act

By A. L. H. Street*

The clause of the California Workmen's Compensation Act which precludes recovery for injury to an employee due to his own "willful misconduct" has been considered by the Supreme Court of the state in a case where a miner working in one shaft of a mine was ordered to go to another when he should finish his work in the first. Instead of going directly to the second shaft, he stopped for a short time in the shade of an ore bin

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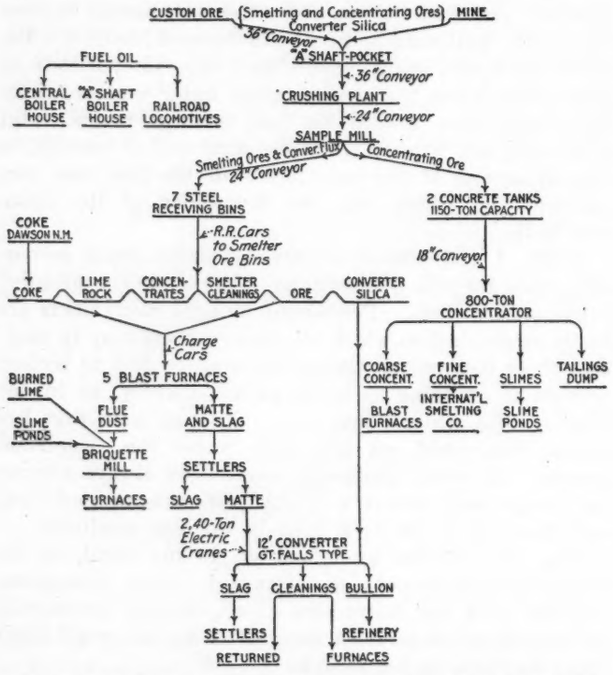
on the surface, to rest, the day being insufferably hot, and was killed by a collapse of the bin.

An award of compensation for his death was resisted on the ground that his own willful misconduct led to the accident, but the court holds that there is liability under the act, it appearing that the place was commonly used by employees for resting and had been regarded as safe. (Brooklyn Mining Co. vs. Industrial Accident Commission, 159 Pacific Reporter, 162.)

## Old Dominion Operations Globe, Arizona*

Mining at the Old Dominion Copper Mining and Smelting Co.'s property at Globe, Ariz., is carried on along 8,500 ft. of the strike of the Old Dominion and other minor veins. Irregular replacement deposits occur in the limestone of the hanging wall. Mining is carried




GENERAL FLOW SHEET OF OLD DOMINION MILLING AND SMELTING OPERATIONS

on at present to a depth of 1,200 ft. Access to the workings is gained through five shafts, three of which are 800 ft. deep, one 1,200 and the other 1,400. The last is the main operating shaft and is a five-compartment. In two of these, 3½-ton skips operate; three-deck cages operate in two others, while the fifth is devoted to pipe lines and cables. The skips are hoisted by a Nordberg 16x28x48-in. twin-tandem compound double-drum hoist. The drums are 7 ft. diameter and have a 5-ft. face on which 2,000 ft. of 1¼-in. rope is wound. The hoisting speed is 1,800 ft. per min. The cages are hoisted by a Nordberg 18x30x42-in. cross-compound geared double-drum hoist having drums 9 ft. diameter and 4 ft. face. Two-layer 1¼-in. rope is used. A hoisting speed of 1,250 ft. per min. is attained. A daily production of 1,200 tons of ore is mined partly by square-sets and partly by cut-and-fill. Of this ore, two-thirds goes to the concentrator and one-third is smelted direct. Electric haulage is employed underground on alternate levels from the 12th down. Three-ton locomotives are used with 20-cu.ft. side-dump cars.

Three types of pockets are used, namely: (1) 125-ton pocket with measuring transfer car from pocket to skip; (2) 250-ton transfer raises with 3½-ton measuring pocket for loading into skip; (3) 200- and 250-ton pockets with slide and 3½-ton measuring hopper for loading into skip.

The water question is a serious one. An assortment of various types of pumps, situated from the 10th to the 18th level, have an aggregate capacity of over 11,000 gal. per min. A pressure system of ventilation is employed, air being forced down two of the shafts, 75,000 cu.ft. per min. being forced down an 800-ft. and 100,000 cu.ft. per min. down a 1,200-ft. shaft. A total of 4,475 hp. is developed in the steam power plants and 1,500 kw. is developed by two mixed-pressure Curtis turbo-generator units operating at 2,300 volts.

The crushing-plant equipment consists of two No. 7½ gyratory crushers, one of which is used for smelting ore and one for concentrating ore. Reduction is continued in one 48-in. and two 36-in. Symons disk crushers. Reduction to 1-in. size is accomplished, screening being done by two trommels, 5 ft. diameter, one 8 ft. and the other 10 ft. long. A monthly tonnage of 37,000 is treated. In the sampling mill a 16-lb. sample is taken from each 100 tons of ore. Further crushing equipment consists of 36x16-in. and 27x14-in. rolls. The final pulp grinding is performed in Braun pulverizers.

The concentrator equipment is as follows:

Shaking screens, three Woodbury classifiers and jigs
Two Traylor rolls, 42x16 in.
Five 8-ft. by 36-in. Hardinge pebble mills
One 8-ft. by 48-in. Marathon mill
Deister Concentrator Co. tables and Senn vanners
Coarse concentrating vacuum tanks, Blaisdell excavator
300-ton 16-box Minerals Separation machine
Two Oliver filters

A tonnage of 800 is treated per 24 hr. and 3.5% copper is concentrated in the ratio of 2.9 to 1. The concentrate runs Cu 8%, insoluble 21%, iron 31% and sulphur 30%. Jigs produce 47%, tables and vanners 30%, and the flotation plant 23% of the total copper recovered. A concentration ratio of 10 to 1 is maintained in the flotation department. The reagent used has the following composition: Coal tar, 85%; pine oil, 3%; coal-tar creosote, 8%; turpentine, 4%. Three hundred tons per day is treated.

OLD DOMINION SMELTING DATA

| | |
|---|---|
| Average tons charge per furnace per day | 282 |
| Per cent. coke to charge | 12.85 |
| Average blast pressure, oz. | 21.5 |
| Average cu.ft. air per min. per furnace | 13,500 |
| Average cu.ft. air per ton charge | 68,926 |
| Average tons air blown to furnace per day | 647.648 |
| Weight ratio—fuel and charge to air | 1:2.034 |
| Matte fall, % | 18.33 |

The composition and analysis of the charge are shown in the following table:

| COMPOSITION OF CHARGE | | ANALYSIS OF CHARGE | |
|---|---|---|---|
| Ores | 56.77% | $SiO_2$ | 22.2% |
| Concentrates | 14.21% | Fe | 31.5% |
| Flux | 12.23% | CaO | 1.8% |
| Fce. secondaries | 2.29% | $Al_2O_3$ | 6.6% |
| Converter secondaries | 14.50% | S | 11.8% |
| | | Cu | 7.75% |
| | 100.00% | | |

In the smelting department are five furnaces, one of which is 19 ft. 3 in. by 44 in., and four are 16 ft. 6 in. by 44 in., all with 5-in. tuyeres. The above details

*Data from pamphlet prepared for recent A. I. M. E. visitors.

were given out to the members of the A.I.M.E. on their recent visit to the plant.

Data on converter lining life are given in the following table which shows the operation of a converter from June, 1913, to December, 1915, during which time it was blowing 13,734 hr.

LIFE OF AN ORIGINAL LINING TO TIME OF FIRST PATCHING

| | |
|---|---|
| Size of converter | 12-ft. Great Falls type |
| Thickness of brick at tuyeres, in. | 30 |
| Total number of blows made | 3,288 |
| Average time of blow | 4 hr. 11 min. |
| Total tons matte charged | 85,578 |
| Copper in matte, % | 43.37 |
| Tons bullion produced | 35,431 |
| Average time to blow 1 ton copper, min. | 23.2 |
| Average tons copper per blow | 10.80 |
| Average blast pressure | 13.2 |
| Air used to blow 1 ton copper, cu.ft. | 178,411 |
| Average air used per min., cu.ft. | 7,691 |
| Tons ore fed per ton matte blown | 0.20 |
| Analysis of ore fed: Cu, 6.90; $SiO_2$, 60.3; Fe, 10.1; CaO, 2.5; $Al_2O_3$, 6.5; S, 2.6 | |
| Average weight of bar made, lb. | 322 |

## Flotation at Mount Morgan*

Experiments in the flotation process have been carried on at the Mount Morgan mine, Queensland, Australia, for several years, and interesting results have been obtained. It may be noted that the Mount Morgan ore is a mixture of iron and copper pyrites with gold in a quartzose gangue. There are two types of ore in the underground workings—smelting ore containing 40 to 50% silica, and ore too siliceous for economical smelting. The material of the latter type is that treated by flotation, an approximate analysis showing 2% copper, 10% iron, 5½ dwt. gold, 73% silica, 1½% alumina, 3½% calcium carbonate and other alkalies, and 10% sulphur. By resolving these analyses into approximately component minerals, it appears that there is 6% copper pyrite, 16% iron pyrite and 78% coarse calcite, etc. The analysis is of course typical and does not represent an average assay of the class of ore.

Flotation experiments were carried on with a standard 24-in. Minerals Separation machine. Experiments were continued for three months, when it was then decided to convert the plant into a large-scale experimental unit treating 100 tons per day, in order that the concentrates produced would, to some extent, defray the expenses of the experiments. Ore from the shaft bin, approximately 6 in. in size, put into a bin of 400 tons' capacity, from which it was fed into a 24x16-in. Blake-type crusher. The machine handles 10 to 15 tons per hour and the power required for its operation was 20 to 26 hp. The crushed product, varying in size from 1½ to 2 in., was conveyed and elevated into bins above the ball mill.

### Dry Crushing in Ball Mills

Eight No. 5 ball mills were put into commission, of which six were constantly in use, these mills making 20 r.p.m. They were driven by pinion-and-spur gearing from one mainshaft, the mills operating independently. The 6-in. steel balls were added regularly with the feed, so as to keep the normal weight of one ton of balls in each mill. Fifty-mesh screens were used, the average size of the crushed product being 10% to 15% plus 60-mesh. Each mill required 15 hp. when crushing at full capacity, which was approximately 0.9 to 1 ton per hr. Products from the ball mill passed into two fines bins, each capable of holding 150 tons. To prevent the escape of fine dust each bin was lined with sheet iron. It will be noticed that all crushing up to this point was dry.

From the fine bins the ore was fed into the Minerals Separation plant by two Challenge feeders, delivering into launders where water pipes were so arranged as to wet the ore with a minimum escape of dust. The feeders were accurate and could control any desired tonnage feeding.

The oil was supplied from a tank kept at a constant head by means of a ball valve that actuated a valve in the bottom of a feed tank at a higher level. The speed of each agitator of the Minerals Separation machine was 295 r.p.m., and the whole machine took from 55 to 60 hp., depending on the rate of feed. The first one to five boxes produced concentrates, and the product of No. 6 box was returned to the feed for retreatment.

The concentrates were first run into round tanks about 20 ft. in diameter and 10 ft. deep, with filter bottoms. These, however, were unsatisfactory, owing to the fact that the wet slime always kept to the outside of the tank and did not thoroughly drain. The difficulty was overcome by running the concentrates into a series of rectangular vats, 9 ft. 10 in. by 10 ft. 9 in., about 3 ft. deep, with cocoa matting resting on a sand-filter bed. The concentrates were run through these in series, three or four always being in operation, and each vat was filled up with concentrates. No trouble was experienced with this system. The drained water was perfectly clear, and the concentrates drained readily in 48 hr. to 7 or 8% moisture.

### Preliminary Flotation Experiments

As a general rule acid is not used in the flotation of this class of ore, and the Mount Morgan ore is no exception. As typical of one of the many trial tests made on this plant before its conversion into a large steel unit, the following results were obtained from a special quantitative test on a certain stope of the mine. The rate of feed was 15 tons per hour, and the dilution 3.5 to 1. The duration of the run was 3 hr., and the oil used, 1 lb. per ton. The ordinary eucalyptus oil was used, and was added ⅔ to No. 1 mixer and ⅓ to No. 3 mixer. The product from each flotation cell was assayed separately, and it was found that the first cell gave concentrates higher in gold, copper and iron than any of the others, the per ton content ranging down from No. 1 gradually to No. 6. For instance, in gold, the first-cell concentrates assayed 55.52 oz. per ton, while the sixth-cell product assayed 18.77 oz. per ton. On the contrary, the silica content varied from 10% in the first cell to 50% in the sixth.

Tests were carried out on the concentration of ore by tabling before flotation. Vanning tests conducted in a dish in the laboratory on various stopes of the mine indicated that a recovery of 40 to 50% of the gold could be obtained, but only about 30% of the copper, unless the crude ore was high in copper. On conducting flotation tests on the residue from the tables more gold and copper were recovered. In the ore a high percentage of copper nearly always indicated a high gold content. The vanning concentrates, however, although much lower in copper than the flotation concentrates, were usually higher in gold. A careful series of tests indicated strongly that although the gold in bulk was associated with the copper, on fine crushing it was not so associated.

Tests were then conducted on a Wilfley table, sectional samples being taken every 9 in. along the table to ascertain

*Excerpt from an article by W. Shellshear, in the "Proceedings" of the Australasian Institute of Mining Engineers, June, 1916.

how the gold followed the various table products. The feed of the table was crushed through 50-mesh screens in ball mills on the main plant and the feed sent direct to the table without classification. The table had a speed of 260 strokes per min., stroke of 5/8 in., fall, 1/2 in. per ft., rate of feed, 1.25 tons per hour. The best results—the concentrates having the greatest value—were, as might have been expected, obtained at the lower end of the table where the concentrate recovery is usually made, and the valuable content lessened as the head of the table was reached.

An interesting feature of the experiments was the use of Sonstadt solution to determine where the gold occurred in quartz or pyrite. In carrying out this test a sample of flotation residue from a large-scale test was taken, assaying 4.4 dwt. gold and 0.55% copper. The sample was put through an 80-mesh screen and the —80-mesh product was then screened through 120 mesh. The sand that remained on the 120-mesh screen was used for the test. It assayed 5.13 dwt. gold and 0.74% copper. The Sonstadt solution was prepared by taking a saturated solution of potassium iodide in water and adding mercuric iodide until the required specific gravity was obtained. In this case 150 grams of the sand from the product between —80- and +120-mesh was added to the Sonstadt solution and stirred well. The solution had to be kept warm to prevent solidifying. The quartz product floated on top of the solution and was skimmed off, filtered free of solution and dried. The assays of the products were: For the quartz product, 3.91 dwt. gold, 0.05% copper, 1.45% iron and 95.50% silica. The mineral product contained 9.79 dwt. gold, 1.85% copper, 34.95% iron and 18.4% silica. As the mineral product contained 9.79 dwt. gold, the copper and iron in the quartz product certainly did not account for the total gold present. Therefore the test proved that a certain percentage of the gold was associated with the quartz.

In order to obtain still more information on this matter, the original sample of residue was screened through 120-mesh, and this product was then screened through 180-mesh. The sand that remained on the 180-mesh screen was used for a second experiment. This test was conducted like the first one, the quartz product being floated off on top of the Sonstadt solution. Assays of the quartz product showed 1.30 dwt. gold, no copper and 0.79% iron. This test is of interest, as it clearly indicated that there was less gold associated with the quartz in the finer product. Hence it seemed reasonable to assume that a certain amount of the gold associated with the quartz was liberated by finer crushing. The residues after flotation were given a Wilfley-table test, and the plain indication was that the gold was in a fine, free state and distributed widely through all the table products.

Some of the flotation concentrates were tested for tellurium, but no trace was found. A sample, the —80-mesh product of the first flotation-box concentrate assaying 47.2 dwt., was panned to see if any free gold was present. After long and careful panning very fine free gold could be seen in the dish. The test proved that free gold floated, and that a certain portion of it, at any rate, was free in the concentrates. It seems reasonable to assume that the gold in the Mount Morgan siliceous ore was free and in a very fine state of subdivision.

The flotation tests showed that the recovery of iron was low. The results from many runs averaged 45 to 60%, the residue assaying 4 to 8% iron. The percentage of iron varied considerably according to the nature of the ore.

The results of laboratory tests indicated that, with a dilution of 1:1 poor recoveries would be obtained, while with thinner dilution, up to 7 to 1, recoveries would be normal. A rapid method of determining the dilution of feed on a large scale was worked out. In this method a number of 50-c.c. cylinders were filled up to the graduated mark with weighed quantities of water and ore, the latter being average crushed feed from the experimental plant. The pulp in the cylinders was then agitated and allowed to settle for five minutes, and the relative numbers of cubic centimeters of settled feed and of clear water were read off. The results obtained were used as standards for subsequent work. Tests on the large scale, checking the method against the ordinary one of weighing, showed that it gave good results, the method of taking the dilution being to fill a 100-c.c. cylinder with pulp out of one of the agitators. A number of large-scale tests showed that the results were not affected by having dilutions ranging from 2:1 and 5:1, provided the feed was not heavy. With a feed of over 20 tons per hour it was found impossible to work with a dilution under 3 to 1, owing to the work being adversely affected if the rate of flow of pulp through the machine was too great. Vanning tests showed that the quantity of fine slime in the feed varied from 15 to 20%. Experiments showed the value of fine crushing.

RESULTS OF FLOTATION TESTS AT MOUNT MORGAN
(Period of One Week)

| Mesh, I.M.M. | Crude Ore | | | | | Concentrates | | | | | Residue | | | | Recoveries | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | Gold, Dwt. | Copper, % | Iron, % | Silica, % | % | Gold, Dwt. | Copper, % | Iron, % | Silica, % | % | Gold, Dwt. | Copper, % | Iron, % | Gold, Dwt. | Copper, % |
| +60 ..... | 16.7 | 5.54 | 1.10 | .... | .... | 11 | 21.38 | 7.30 | .... | .... | 23.3 | 4.07 | 0.75 | ... | ... | ... |
| +80 ..... | 4.7 | 5.21 | 1.32 | .... | .... | 6.6 | 19.28 | 8.79 | .... | .... | 6.6 | 3.26 | 0.47 | ... | ... | ... |
| +120 ..... | 27.0 | 4.23 | 1.75 | .... | .... | 40.2 | 26.12 | 11.48 | .... | .... | 23.3 | 1.95 | 0.22 | ... | ... | ... |
| —120 ..... | 51.6 | 7.67 | 2.44 | .... | .... | 42.2 | 40.82 | 13.23 | .... | .... | 46.8 | 1.63 | 0.19 | ... | ... | ... |
| Bulk ..... | 100 | 6.03 | 1.90 | 10.81 | 74.30 | 100 | 31.02 | 11.75 | 32.21 | 19.40 | 100 | 2.44 | 0.35 | 6.78 | 64.6 | 84.0 |

### The Use of Different Oils

Tests were tried on different oils, principally eucalyptus and various blendes of eucalyptus with other oils. Laboratory tests backed up by large-scale operations indicated that of the eucalyptus oils used, those of the type *eucalyptus amygdalina* and *eucalyptus dives*, containing phellandrene, give better results than those of the other types which did not contain phellandrene. Eucalyptus distilled from local plants of the type *eucalyptus citriodora* and oil distilled from box were tried, but results were not so good as from oils of the phellandrene type. Turpentine, which is impossible to distinguish from the first distillate of eucalyptus, is too often used in large quantity as a diluent of eucalyptus and too much stress cannot be laid on the importance of exact specification being complied with before eucalyptus in large lots is purchased.

In the plant it was found that flotation was influenced by an excess of oil almost as much as by too little. Too much oil caused heavy float in the residue launder. Experiments on the large scale, adding oils continuously for a long period to the dry feed at the Challenge feeders, proved that the percentage of insoluble in the concentrates did not increase below normal.

Oleic acid and residuum oil were tried in the laboratory, but the results were not sufficiently good to be tried again on the large-scale plant.

The method adopted in the large-scale concentration plant showed that although in some cases very little extra gold was recovered by vanning and flotation tests, as compared with straight flotation, in most cases the extra recovery was appreciable, and this fact was really the main one in considering the erection of tables before flotation in the large treatment plant. Other advantages were the recovery of a large proportion of coarse iron concentrates which, when mixed with finely ground flotation concentrates, would give a product easy to handle. In addition there was a possibility of treating smelting ore in the concentration plant. The method adopted for the plant was, therefore, primary crushing to about 40-mesh and tabling, recrushing table rejects to 80- or 120-mesh and treating by flotation. The smelting ore required very fine crushing to get good recoveries. As no work was done in the large plant on this class of ore, only laboratory tests were carried out, which continued to show the advantage of combined treatment. The accompanying table is a brief summary of the results that were obtained by experimental plants at work on a large scale. The flotation costs may be summarized as follows: Supervision, 0.9d.; operating wages, 1.82d.; power, 1.46d.; material in general, 0.1d.; oil, eucalyptus and residuum, 4.98d.; maintenance, 2.85d.; plant and general maintenance, 0.62d.; and sampling and assaying, 4.45d.; a total of 1s. 5.18d. (about $0.35) for the whole operation.

## Metal Mine Accidents in 1915

There was a slight decrease in the number of men killed in the metal mines of the United States in 1915 as compared with 1914, according to the compilation of Albert H. Fay of the U. S. Bureau of Mines. The total number killed as reported to the Bureau of Mines by the operators was 553 in 1915, as compared with 559 in 1914, 683 in 1913, 661 in 1912, and 695 in 1911. The number of men reported employed, however, during 1915 was slightly less than the previous year, the numbers being 152,118 in 1915 as compared with 158,115 in 1914. The fatality rate, therefore, for 1915 was slightly higher than for the preceding year, being 3.64 per 1,000 men employed in 1915 as against 3.54 per 1,000 for 1914; 3.57 in 1913; 3.91 in 1912; and 4.19 for 1911.

The decrease in the number of employees is more apparent than real. In 1913 and 1914 the bureau collected accident and labor statistics from both mines and metallurgical works. These data were collected on separate forms so there is the possibility of including as mine employees many mill and smeltery men. In 1915, the same card contained forms for both mines and metallurgical works, and being filled out at the same time eliminated all possibility of duplication. The number employed at mines and metallurgical works for three years is shown in the accompanying table.

EMPLOYEES OF U. S. METAL-MINING INDUSTRY

| Year | Mines | Mills | Smelteries | Total |
|---|---|---|---|---|
| 1913 | 191,276 | 14,985 | 20,564 | 226,825 |
| 1914 | 158,115 | 15,128 | 27,879 | 201,122 |
| 1915 | 152,118 | 18,564 | 31,327 | 202,009 |

There were reported 35,295 nonfatal injuries for 1915, of which 35 were permanent-total disability; 574 permanent-partial disability; 7,242 other injuries of a temporary nature involving a loss of more than 14 days, and 27,144 minor injuries wherein the time lost was one to 14 days. The nonfatal injury rate per 1,000 men employed was 232 as compared with 191 for 1914. This increase is not necessarily significant of an increased hazard, but the real dangers are more nearly set forth by reason of better records at the mines and more complete reports to the bureau.

## Minerals Separation vs. Miami

In the suit of Minerals Separation, Ltd., against Miami Copper Co. in the United States District Court for Delaware, at Wilmington, a decree was signed by Judge Bradford, Oct. 5, 1916. The judge also signed an order staying the injunction on condition of the immediate filing of a bond for $250,000 and thereafter of monthly reports of the particulars of the Miami flotation operations, with leave to the plaintiff to move from time to time to increase the amount of the bond upon showing that the profits of the defendant from its infringing operations had exceeded the amount of the bond.

At the argument in open court Judge Bradford said that an infringer was to be treated as a trustee for the patent owner and that all the profits from the infringement were to be paid to the patent owner. In the discussion as to the amount of the bond, the defendant's counsel stated that three years ago the Butte & Superior company had stayed the issuance of a preliminary injunction against them in the suit of Minerals Separation, Ltd., by filing a bond for $75,000 and making monthly reports of its flotation operations. Plaintiff's counsel replied that these reports, filed in court from month to month, showed that the profits of the Butte & Superior company, due to flotation, were approximately $15,000,000 and therefore the bond was obviously inadequate. Judge Bradford then stated that of course a plaintiff can always move to increase the amount of a bond, and therefore he based the amount which he fixed in the case before him upon a rough estimate of a month's operations and gave leave to increase the amount from time to time, as previously noted.

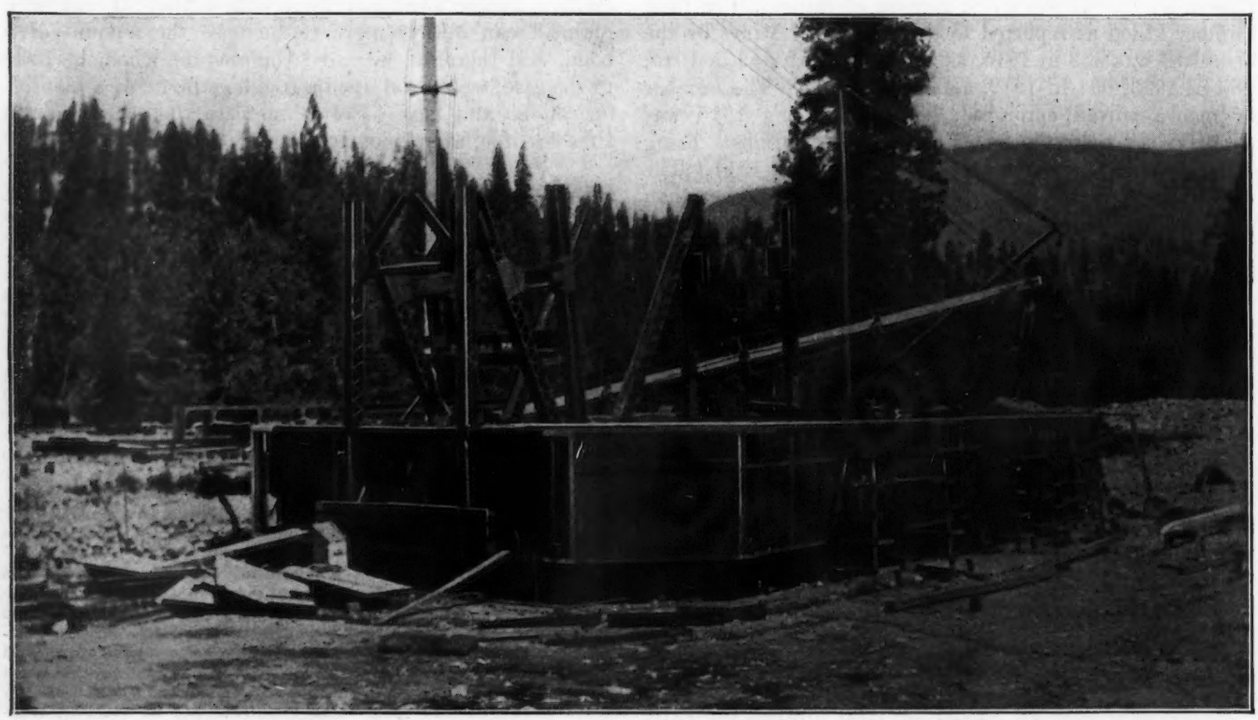
**Broken Hill Proprietary Co.,** Broken Hill, N. S. W., Australia, for the half-year ended May 31, 1916, reports a working income of $4,885,487 from which other charges amounting to $2,950,276 are deducted, leaving $1,935,211 balance from which $573,969 in dividends were paid, leaving a balance of $1,562,604. There were 66,423 tons of ore raised from the mine. The crude-ore sections of the mills handled 56,820 tons of sulphide ore, producing 9,352 tons of lead concentrates, assaying 59.62% lead and 27.88 oz. silver per ton. The regrinding section dealt with 26,929 tons of tailings and produced 698 tons of lead concentrates assaying 53.10% lead and 28.38 oz. silver per ton. The zinc-flotation plant was closed down on Apr. 13 until a more regular market for its products could be obtained having treated 54,714 tons and produced 13,189 tons averaging 45.95% zinc, 12.8 oz. silver and 6.3% lead.

Due to the Christmas and Easter holidays and a strike for the 44-hr. week (which was subsequently granted) the mine was only worked 3½ months out of the 6.

At the Newcastle steel works the blast furnaces were in operation continuously giving an output of pig-iron of 53,974 tons. The rolling mills produced 36,862 tons of a varied product, consisting of blooms, billets, sheet steel, rails, fishplates and joints and channels. The coke ovens produced 58,405 tons of coke, all of which was consumed in the blast furnace operations. As a byproduct, 615,584 gal. of tar were produced and sold. The requirements of steel in Australia warrant an increase in production and plans are under way for an addition to the blast furnace and coke oven plants. The quarries produced 135,941 tons of iron ore.

# Photographs from the Field

This small dredge of the Alta Bert Gold Dredging Co., near Trinity Center, Calif., has yielded some remarkable returns. The Alta Bert and other property in the vicinity have recently been purchased by the Estabrook interests of Boston and a modern steel dredge will probably be built



Hull of the new 9-cu.ft. all-steel dredge of the Pacific Gold Dredging Co., recently launched in Coffee Creek, Trinity County. This company is a subsidiary of the Yukon Gold Co.

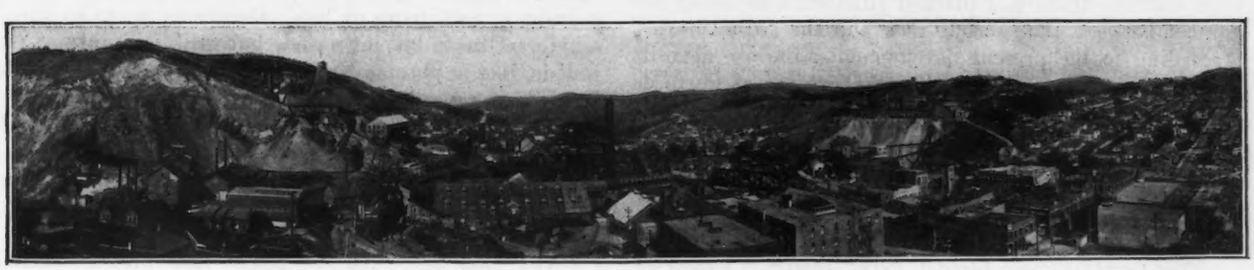
TRINITY COUNTY, CALIFORNIA, IS RECEIVING MORE ATTENTION FROM DREDGE OPERATORS

Homestake Mining Co.'s Terraville opencut, looking south

Homestake plants and central part of Lead, S. D. Taken from Ellison shaft

Homestake's opencut near Lead. B. & M. shaft at right; Highland shaft at left

Mineral Point 100-stamp mill and Father de Smet opencut in background



The eastern part of the town of Lead and some of the Homestake plants

RECENT VIEWS OF THE HOMESTAKE GOLD MINE IN THE BLACK HILLS, SOUTH DAKOTA

# Correspondence and Discussion

## Cerro de Pasco District, Peru

A good description of the Cerro de Pasco district, Peru, is so rare that when an article such as the one by Singewald and Miller[1] appears, it is of more than passing interest.

In 1904 I made an examination of the coal and copper properties of the Cerro de Pasco Mining Co., but was called back to report—as is too frequently the case—before I had really done much more than make a thorough reconnaissance. Upon my return I requested permission to publish some observations of scientific interest, but this was refused by the controlling interests. So much time has elapsed since then that I feel that I may now make a statement supplementary to the article referred to without violating professional ethics. I shall have to depend solely upon my memory, as my notebooks are not at this moment available.

The Cerro de Pasco copper deposits are due to the intrusion of a mass of rhyolite into a series of cretaceous sediments—limestone chiefly, so far as now known. The contact between the intrusive and the sediments is along a north-south fault, and it is due to this that the deposits immediately along the contact, as indicated by the open cuts, have such a marked north-south alignment. The formation of these deposits along the contact was accompanied by the usual contact products. Intense silicification of both the igneous and sedimentary rocks is the effect most noticeable at the surface. However, I believe that the sedimentaries have suffered more from the contact reactions than has the igneous rock.

These deposits along the contact were among the earliest exploited, and at the time of my examination the company's operations were chiefly confined to the vicinity of the old workings. However, replacement deposits occurred well out in the limestone to the east of the contact. The workings in a large deposit from a quarter to a half mile east of the contact had caved and buried a number of miners years previous to my visit and had not then been reopened. To the west of the contact in the intrusive rock mass occur the east-west vein deposits.

To make a comparison, I would say that the Cerro de Pasco district has its nearest analogue in the Bisbee district of Arizona. The Cerro de Pasco rhyolite corresponds to the intrusive of Sacramento Hill and the north-south fault corresponds to the Dividend fault of Bisbee. In both districts there is a marked silicified zone along the contact between the igneous rock and the sedimentaries. According to the present developments, the ore deposits in this zone are of much greater importance at Cerro de Pasco than at Bisbee. The two districts differ in a structural way in that the sediments of Cerro de Pasco dip in general to the east, away from the contact with the intrusive rock, whereas in Bisbee they dip in general toward the contact.

At the time of my visit the company had just got fairly started and, as the result of the lack of development, many things were puzzling which further work would have cleared up. I recall spending some time in a drift, studying the material in which it was driven for over a hundred feet long (as I remember it) and in which material it ended. The drift was not timbered. The material looked like a peculiar breccia. Finally, finding a cross-section of a small piece of old timber embedded in a wall, I decided that it must be old filling cemented, after a lapse of perhaps a hundred or more years, into quite a resistant mass.

It is to be hoped that someone will give us ere long the results of a comprehensive study of this interesting and important copper district. J. Morgan Clements.

Chicago, Ill., Sept. 20, 1916.

[1] "The Cerro de Pasco District, Peru," Joseph T. Singewald, Jr., and Benjamin Le Roy Miller, "Engineering and Mining Journal," Vol. 101, pp. 1015-18.

## Natural Gas Pipe Theory

Misther Editor—Fillin' me pipe with some av Tim's tobaccy, I sat down to study more about thim ixtra-latheral rights av ile-drillers. Drowsy-like, I burnt me finger on a coupon-store match, an' whin I fell asleep at the nixt page, I was wishin' for an owld-time sulphur match. To h—— I wint afther it in me dream.

"What do ye want?" sez a 4th assistant deputy. "A bit av sulphur," sez I. "Have ye a card?" sez he. "I'm the pavin' conthractor," sez I (for manny's the raysolushun I've passed); "I'm studyin' the foundayshun." "Yes, sir; thank ye, sir," sez he, bowin' an' scrapin'; "this way, sir." An' with that he ushers me into a big room filled with rolls av asbestos an' sich like.

In a minute into the libr'y comes an owld man who greets me with a noncommittal smile, shakin' me hand with wan av his while he pats me wrist with the other. "Now, about that sulphur," sez he, "ye know we have plinty here." "So the preachers say," sez I, with a sickly grin. "Oh, thim!" sez he, lookin' a bit worried. "Ye mane the owld-fashioned kind. They're only ign'rant. But we won't argy the p'int. Will ye concede that there's plinty av $FeS_2$ hereabouts?" "'Tis indisputable," sez I, "bein' a primary ore or a kindergarten wan, as ye might say. Fool's gold, as some calls it." "The more fool thim, perhaps," sez he, "for 'tis the saycrit av much wealth in war times. An' will ye admit that there's some $CaCO_3$ above?" "I can't deny it," sez I. "An' how about $H_2O$?" he smiles. "I'll accipt that, with a grain av salt, more or less. Oceans av it, to be sure," sez I, gettin' a bit int'rested, but still ign'rant. "Yis, indade," sez he; "some NaCl, an' ye have all the reaygints. Now, do ye raycall that under great pressure ye sometimes do what ye wud not otherwise undertake?" "Well," sez I, "manny's the pressin' invitayshun I've had, an' me gran'mother was Scotch." "'Tis irrilivant," sez he. "What I ask ye is, will ye accipt pressure?" "If ye force it on me, I must," sez I, sweatin' a bit.

"Ah!" sez he. "An' ye notice how pressure makes heat. Pressure is another av thim saycrits av success.

'Tis nawthin' but push an' persistence. Pull is imaginayshun.

Well, now, comin' back to sulphur. Many av the professor childern upstairs will tell ye that much av the sulphur was made from gypsum an' organic matter. Whin ye ask who made the gypsum, they tell ye that's in tomorry's lesson. Ye will notice that they're plumb wasteful av reaygints. Wan av thim blamed it on bacteria whin up ag'inst it for the inergy facthor.[1] Do ye know that $FeS_2 + \text{heat} = FeS + S$?" sez he, innocent-like. "Sure thing," sez I, jumpin' at the bait. "Howld on," sez he, raisin' his hand like a traffic cop. "Not until the pressure is rayduced. An' where wud it go, annyhow?" "I dunno," sez I, rubbin' me chin, "but 'tis ready to travel whin the road is open an' the 8-hr. bill's signed, I'm thinkin." "Did ye iver thravel far without a vehicle or ilse wan av thim f.o.b. Detroits?" sez he, raybukin' me an' continuin' to monopolize the conversayshun.

"Whin a crack happens, we fills it with what comes handy. If there's plinty av $FeS_2$ in the dope, some av the sulphur is loosened up ready to break away whin nice partners is near. If the crack ixtinds to wan av thim basins av salt wather, iverything that can goes into solushun. Heat an' pressure raises the sacherayshun p'int. Salt is a good loosener, an' as Huckleberry Finn sez, 'in a barrel av odds an' ends, things gets mixed up an' the juice kind av swaps around.' As the pressure varies a bit here an' there, so do the rayacshuns. I will give ye a few av thim an' ye can folly it up as ye like." An' with that he takes a bit av blue billy an' marks on a sheet av asbestos, like this:

$$FeS_2 = FeS + S$$
$$FeS_2 + H_2O = FeO + H_2S + S$$
$$H_2S + S = H_2S_2$$
$$3FeS_2 + 4H_2O = FeO + Fe_2O_3 + 4H_2S + 2S$$
$$4H_2S + 2S = 2H_2S_2 + 2H_2S$$
$$3FeS_2 + nH_2O + 3NaCl = NaCl,FeCl_2 + Na_2SO_3 + 4H_2S + FeS + FeO + (n\text{-}4)\ H_2O$$
$$CaCO_3 + H_2S + H_2O = CaSO_4 + CH_4$$
$$2CaCO_3 + H_2S + S + 2H_2O = 2CaSO_4 + C_2H_6$$
$$3CaCO_3 + H_2S + 2S + 3H_2O = 3CaSO_4 + C_3H_8$$
$$6CaCO_3 + 3H_2S_2 + 6H_2O = 6CaSO_4 + CH_4 + C_2H_6 + C_3H_8$$
$$CaCO_3 + H_2S_2 + H_2O = CaSO_4 + CH_4 + S$$

"The divil ye say," sez I, "'tis queer, but 'tis gud arithmetic. An' is that how ye make nacheral gas an' petrolyum?"

"Listen!" sez he. "In the first place I'm not what ye call me. I'm but the trustee av inergy for the Big Boss. In the sicond place, I'm not annything more than a dream ye're havin'. An' in the third place, yer pipe is out annyhow. But ye will often find some av thim things together, an' ye will hear all kinds av stories about thim bein' there. 'Tis like the egg an' the hen. Ye don't know which happened first, but if a hen cackles, ye should luk first to see if it's a rooster, an' if it is not, then ye shud have since enough to luk for an egg. Whin ye find sulphur, sometimes ye find gypsum an' sometimes ye don't. Whin ye find gypsum with or without sulphur, sometimes ye find nacheral gas, petrolyum an' sich like in some place that used to be uphill from thim. Whin ye find petrolyum there's some things ye always find close by. Go study it up whin ye're wide awake."

[1]Pantanelli, quoted in "Mineral Resources," 1910. Part II, p. 792.

Jist then I wakes up with a joomp an' spills the hot coals av me pipe on the new parlor rug. "How long have I been asleep?" sez I. "About a minute or so," sez Kathleen, "but ye've been smokin' steady. I see in the evenin' paper that since somebody made a crack an' started to raise a little h——, the ile thrust announced that due to the increase in the supply av nacheral gas an' crude petrolyum the price av gasoline will drop until further orders."

"'Tis plausible," sez I. BILL MCGINTY.

Brooklyn, Oct. 16, 1916

## The Metric System

In the *Journal* of Apr. 15, 1916, there are two articles—one reprinted from the *American Machinist*—warning and protesting against the compulsory introduction of the metric system in the United States. Engineers abroad do not understand this point of view. The subject is not merely an internal American one, but one in which the whole civilized world is interested. It is really not gratifying for technical people—who are the pioneers of progress in the world—to see two great and influential technical journals like the *Engineering and Mining Journal* and the *American Machinist*, predestined to take the lead in helping energetically toward uniformity, rolling stones in the way of the men who are toiling for progress.

There are in this matter certainly lots of difficulties—also for technical journals—but one must not lose sight of the enormous advantages, which are so obvious that a great people like the American should earnestly try to overcome all obstacles. By introducing such a change it would of course be necessary to make regulations for at least 10 or 20 years as the time of transition. In trade and industries, within a period of 10 years, drawings and patterns surely become obsolete and need renewing. Well, this renewing may be done in the metric system as easily as in the present one.

Trading with all countries having the metric system is certainly to some extent handicapped because of the complicated American system of measures and weights. Perhaps also Americans are not aware of the difficulties foreigners have in studying the American technical and scientific literature, on account of the same impracticable system of measures.

May I be permitted to instance another point, even if not directly connected with the theme? Why are Americans always giving their metal production in pounds—generally seven or more figures—instead of in tons (no matter what kind of ton)? Certainly not because they are so fond of big figures, for if so, they would quote their huge production in ounces or drams. They do so because their fathers and grandfathers did so. Is it not strange that the people with the most important metallurgical industry of the world and so progressive in every respect should be so conservative in this matter?

In different parts of the British Empire we see also a "prometric-system movement," which is especially strong in India and South Africa. Once the British Empire has made the big change, America certainly will follow. I think it would be better for America to take the lead. ROBERT HESSE.

Tsumeb, Southwest Africa, July 30, 1916.

# Editorials

## Quien Viva?

Since the days of Cortez the challenge in Mexico has been, "Who lives?" The priest Hidalgo, seeking to overthrow the Napoleonic rule, told his Indian followers that somebody or something lived, indicating to them by precept and example the well-known maxim, "The Lord helps those that help themselves." The Texans, both of *mestizo* extraction and Anglo-Saxon ancestry, endured for years the increasing tyranny imposed by the Dictator Santa Ana upon the land of their birth or adoption. Texans having resolved that Texas should live, Texas labored and brought forth itself—a lively infant which thrived for a decade, more or less, before adoption into the more congenial of the two neighboring families. While the children of the respective families have been making faces at one another over the back fence for the period ensuing since the said fence was built, some of the children have grown up to man-size in body and brain, while others remain childish.

The memorandum of facts and conditions submitted to the American members of the American-Mexican Commission, under date of Sept. 25, 1916, by the committee representing a conference of 45 companies is a calm and dignified presentation of evidence such as would receive scant consideration at a banquet presided over by one of the whilom companions of Alice in Wonderland. But the American-Mexican Commission, which has moved its headquarters from New London to the Hotel Traymore, in Atlantic City, N. J., should not be considered as a banquet or junket proposition, or even as anything so childish as the A B C of the nursery period—representing, rather, an algebraic exposition of the unknown quantities $x$, $y$ and $z$, whose solution depends partly upon the equations submitted.

The companies represented in the conference are not owned by a small group of capitalists, as some childish or malicious folks are wont to allege, but are practically all stock corporations, the shares of which are widely distributed among many thousands of American citizens who cannot afford to lose the small savings and income which these shares represent. The total cash invested in the properties is $125,000,722. Plants were operated in 14 Mexican states, and in former times, such as in 1912 (under President Madero), there were 62,216 Mexicans employed, with the aggregate annual payroll of Mexicans and Americans amounting to $18,726,090 U. S. currency.

The total normal annual production of the 45 mines in question was: Copper, 74,984 tons of matte or bullion; zinc, 46,765 tons of ore; lead, 70,939 tons of bullion; silver, 31,892,735 oz.; gold, 252,843 oz. For the first six months of 1916 it is estimated that but 6,000 Mexicans were employed, the aggregate payroll amounted to $3,671,302, and the production of copper, zinc and lead, as above, was 23,156 tons, 11,183 tons and 2,928 tons respectively, and but 6,200,339 oz. of silver and 39,895 oz. of gold.

The memorandum is not presented as a demand for restitution of losses or for damages for injuries received, but to make clear the conditions necessary for industry to live. In brief, the American and Mexican mining and smelting interests concede the right of Mexicans to carry on their political affairs in their own fashion, provided that the rights of citizens of other countries are respected. This is in line with the rational philosophy of Herbert Spencer, which in principle teaches that true liberty is the right of the individual to enjoy himself to the limit in whatever way his fancy may dictate, provided that in so doing he does not infringe upon the rights of others. Unfortunately, the Spencerian system of deeds is not followed in a greater degree than is the Spencerian system of writing, irrespective of the number of pens employed. But organized society does not sanction offenders in this respect, and only the rational should be classed ultimately as among the elect. The inconsistent conduct of the de facto (*sic*) government and its inability or disinclination to protect lives and property are shown clearly and beyond cavil by a summary of conditions at different properties, dates being given and names omitted only to avoid being unduly offensive.

While the old legal rates of taxation on production were in themselves exacting, being based upon the gross value of the ore or bullion produced instead of the net product as is the practice generally in the United States, the new rates are regarded as grossly excessive and confiscatory. The new pertenencia tax introduces a rate per pertenencia, increasing in arithmetical progression with the number of claims held; being $2 per hectare on groups from one to 10 hectares, $4 each from 11 to 50, $6 each from 51 to 100, $8 each for groups containing more than 100 claim units. From 1891 to 1905 the rate was 10 pesos flat, and after 1905 it was 6 pesos each for the first 25 hectares and 3 pesos each for additional claims.

In a manner as concise as the wording of the Declaration of Independence, eight classes of decrees are cited and each class is described in brief and in particular. In conclusion, the benefits to humanity of a just and peaceful solution of the problem are touched upon, and it is suggested to the American members of the Mexican Commission that they seek to obtain from the Mexican members and through them from their government, positive and unequivocal assurances of the intention of that government in respect of American enterprises in Mexico, and an explicit understanding respecting future status and rights and obligations, and measures for enforcing them.

This manner of procedure is most commendable and could not be objected to by the proudest advocate of peace. Undoubtedly American character has taken on considerable refinement and punctilious regard for ethical niceties. In the rough-and-ready days when the boisterous volunteers of Scott and Taylor marched along singing "Green grows the grass and green grows the tree," the populace trembled as they whispered *"Ay,*

*Dios mios, que ya vienen los gringos."* Of late there has been a different intonation in the muttering of that once musical nickname.

Meanwhile, contemporaneous news items report various movements of General Villa and General Unrest. As we bow our heads in ignominious shame, let us consider what shall be our answer when challengd by the cry of "Quien Viva?"

## Institute Membership

An announcement in the *Journal* to the effect that the American Institute of Mining Engineers had limited the increase of membership to five new members each month would cause a number of young mining engineers to wake up and protest. Such a move might be more or less beneficial, for the desire to do a thing is stimulated by prohibitive decrees.

A member of long standing recently expressed himself as greatly impressed with the value of the papers presented at the Arizona meeting; with the earnestness of the discussions; and, above all, with the value that young men obtain in the way of ideas and suggestions gained and new oportunities attained through meeting, on a basis of fellowship and equal footing (for the nonce at least if not for always), with the older and more experienced engineers. In spite of all the derision that has flavored discussions of dowsing-rod philosophy, there undoubtedly is such a thing as human magnetism; and the magnetic concentration of a modern Institute meeting is capable of producing results far more beneficial than may be imagined by an outsider. For the men who are unable to attend the big meetings, the different section gatherings at frequent intervals build up a fraternal conviviality and lead to an interchange of opinion that is not literally sectional.

There could be no more eloquent commentary on the advantages of Institute membership than a statement that many former members, who through ennui or penuriousness dropped out some years ago, have been so roused by an occasional peek through the fence that they marched proudly up to the gate and paid up all arrears so as to get in the game again.

## Paying a National Debt

It is a habit with certain individuals who sometimes pose as mining experts to refer to the reserves of a mining district, or even of a single deposit, as being sufficient to pay off the national debt of this or that country. Usually the country specified is the one where the patter is to be used as a solvent to loosen up the cash of "tight-wads," since it is the latter class which hopes for big profits. The glamour of the phrase certainly appeals to the imagination, and a mining man without imagination is an ordinary plodder. By stimulating the imagination, a mental picture may be built up in pyramidal form, with silver bullion topping copper ingots and surmounted in turn by smaller but more attractive gold bricks.

But there is another kind of national debt which cannot properly be measured by any monetary standard. Each nation has a debt of honor and of respect always due and always payable to other nations and a debt of self-respect and protection to its own components. Although a monetary national debt may be, and usually is, refunded and increased or even at times successfully repudiated, the moral debt must constantly be paid or the nation ceases to exist. In some instances the moral debt of one nation to another may be converted to a monetary equivalent or substitute, with or without the accompaniment of force in the process of collection. But the entire fabled pavement of hell, figuratively conceived as a mineral deposit, would not suffice to pay the moral debt of a nation untrue to itself.

Probably there was never before in the history of copper such a situation as exists at present—a situation wherein the supply that refiners expect to make during the next three months is all but completely sold out and belated consumers must pay high premiums for the relatively trifling quantity of copper for prompt delivery that is available from second hands. This situation is strongly reminiscent of what existed in spelter in 1915. In both cases the causes were the same; that is, deficiency in manufacturing (smelting or refining) capacity in the face of a plethora of raw material. The tension in zinc was relieved by swiftly providing more smelting capacity, which it was possible to do. Copper refining, on the other hand, requires larger and more complicated machinery and there is great delay in getting it, wherefore increase in production is not coming along so rapidly. But of course the solution of the problem in copper, as it was in zinc, is only a question of time. Similarly in the matter of aluminum, wherein there is perhaps the greatest stringency of all the metals.

The scarcity and consequently the steeply increasing cost of news print paper is one of the serious questions of the day, but the Federal Trade Commission in a circular letter to publishers advising a cutting down of the size of Sunday newspapers makes a strange remark when it says that it "feels the elimination of certain features would meet with public approval and would not decrease the revenues of the publishers." It has been the theory heretofore that the producers of Sunday supplements, etc., were catering to a public demand. Why should they at great expense try to cram down the public throat something that the public does not want? Has it all been a mistake? Let the Federal Trade Commission explain itself. Some of us who have been looking vainly for a Sunday paper without the slush and comics will have great pleasure in witnessing an unraveling of this matter.

It must be just as painful to a war-bride to be deserted at the altar as it is to one from whom the metaphor is borrowed, but this seems to be what has happened to the Tennessee Copper Co., which is undergoing a species of reconstruction involving the provision of a large amount of new capital. The Tennessee Copper Co. had contracted its production of sulphuric acid to another company for a term of years before the war began, and the benefits that were going to accrue to it were never so great as was intimated at one time when its shares were a center of attention in the stock market, but nevertheless, the enhanced value of copper ought to have made things easy for the company. Apparently the management of this company is now going to return to Adolph Lewisohn and his able coadjutors, who conducted its affairs so successfully during an earlier period.

## BY THE WAY

Members of the A. I. M. E. trip were much interested while in Bisbee in the mining of the old Copper Queen slag dumps for resmelting at Douglas. Doctor Douglas is quoted as saying: "We never used to make a slag over 1 or 2% copper, but we are mining it now and getting 3% out of it."

Arizona of course is dry, but a learned judge has ruled that the law permits anyone to import any amount for personal consumption. The division superintendent of the railroad at Douglas is said to have come into his office one morning and asked his clerk: "William, how many cars of 'personal consumption' came in last night?"

The estate of Herman A. Frasch, president of the Union Sulphur Co., who died in 1914, has been reappraised for taxation with the result that its value is now put at over $10,000,000, or more than three times the first valuation. The chief change is in the price set on 505 shares of Union Sulphur stock which formed a large part of the assets. The official appraiser now puts this stock at $12,003 per share and claims that this is fully justified by the assets of the company and its present financial position. This is away ahead of any of the "war stocks."

American exports have finally passed the half-billion a month mark. Statistics issued recently by the Bureau of Foreign and Domestic Commerce, of the Department of Commerce, show that the exports for August amounted to $510,000,000, which is not only the record for this country, but for all countries. It is $35,000,000 higher than the previous high record, which was established in May, and $45,000,000 higher than the June total. Imports, on the other hand, showed a decrease for August, the total being $199,247,391. This is a decline of $47,000,000 as compared with June, the record month. It is greater than the total for any previous August, however. The exports for the year ended with August totaled $4,750,000,000 and the imports $2,300,000,000, both totals being far in advance of those for any similar period.

Anybody has a right to change his mind. Consistency is no virtue. Indeed, change of mind is an evidence of the intelligence that acquires new knowledge. The changes of President Wilson, however, are rather startling, judging from extracts dug up by the *Boston News Bureau*, as follows:

Extract from a baccalaureate sermon of June 13, 1909, by Prof. Woodrow Wilson.

You know what the usual standard of the employee is in our day. It is to give as little as he may for his wages. Labor is standardized by the trade union, and this is the standard to which it is meant to conform. No one is suffered to do more than the average workman can do. In some trades and handicrafts no one is suffered to do more than the least skillful of his fellows can do within the hours alloted to a day's labor, and no one can work out of hours at all or volunteer anything beyond the minimum.

I need not point out how economically disastrous such a regulation of labor is. It is so unprofitable to the employer that in some trades it will presently not be worth his while to attempt anything at all. He had better stop altogether than operate at an inevitable and invariable loss. The labor of America is rapidly becoming unprofitable under its present regulation by those who have determined to reduce it to a minimum. Our economic supremacy may be lost, because the country grows more and more full of unprofitable servants.

Extract from a letter of Woodrow Wilson, dated Jan. 12, 1909, in reply to an invitation to speak at a banquet of anti-strike and anti-boycott advocates:

I am a fierce partisan of the open shop and of everything that makes for individual liberty, and I should like to contribute anything that it might be possible for me to contribute to the clarification of thinking and the formation of right purposes in matters of this kind.

At a dinner in the Waldorf Hotel on Mar. 18, 1907, Dr. Woodrow Wilson spoke as follows:

We speak too exclusively of the capitalistic class. There is another as formidable an enemy to equality and freedom of opportunity as it is, and that is the class formed by the labor organizations and leaders of the country.

The foregoing remarks expounded some good economics and sound sociology, which are quite different from the ideas unfolded in the address that thrust the eight-hour law down the throat of Congress.

Much valuable information may be gained from the columns of the daily newspapers. Particularly as regards subjects of interest to mining people, the information may be whatever is desired, and one's own estimate of value may be placed upon it. A New York daily gives us the following information, on successive days, about the tax on mines in Mexico:

Mexico City, Sept. 22—The mining decree, providing that mining properties which are not worked for two consecutive months in each year shall be forfeited, is not aimed at owners of mining properties that cannot be worked because of natural difficulties or disturbed conditions, the Department of Fomento (treasury) explained to a representative of the Associated Press, but is directed at holders of large mining tracts making no efforts to develop them.

Mexico City, Sept. 23—The Treasury Department last night issued a circular in answer to the appeals of individual mine owners for the remission of taxes on mining property. The circular declares that the titles given are in the nature of a lease of subsoil from the government, which is the sole owner of the land. The leases do not give absolute ownership, but only the right to exploitation. As long as persons hold titles they must perform their part of the contract by paying taxes, says the circular, whether or not the titleholder is in possession of the property or able to work it.

The late Robert S. Towne was a metallurgist, smelter and operator to whose accomplishments the writers of his obituary notices gave rather inadequate recognition. After a comparatively short time in the mining camps of Colorado, he became ore buyer and assayer for the Kansas City Smelting and Refining Co. at El Paso in 1886. The Sierra Mojada mining camp was then in its prime, and he established ore-buying agencies and finally organized the Mexican Ore Co. The heavy receipts of ore from Mexico resulted in building the El Paso Smelting Works by the controlling interests in the Kansas City Smelting and Refining Co.—August R. Meyer, Nathaniel Witherell and Mr. Towne. Meyer and Witherell at that time controlled the Kansas City company and the Arkansas Valley Smelting Co. Later the Mexican Ore Co. was consolidated with the three smelting plants and the name was changed to the Consolidated Kansas City Smelting and Refining Co. In those days all the ore from the Sierra Mojada was hauled by mule teams 70 mi. to Escalon; in 1890 Meyer, Witherell and Towne built the Mexican Northern Railway. In 1894 Mr. Towne organized the Cia. Metallurgica Mexicana and built his smelting plant at San Luis Potosi. When the American Smelting and Refining Co. was formed in 1899, he disposed of his holdings in the Consolidated Kansas City Smelting and Refining Co. and from that time on devoted himself to the smelting business at San Luis Potosi, to the Mexican Northern Ry., to the building of the Teziutlan plant of the Teziutlan Copper Co. and to various mining ventures, including the old Sombrerete mine, in Zacatecas and the Montezuma mines in Santa Barbara.

## New Publications

**Copper, from the Ore to the Metal.** By Hugh K. Picard. 4½x7, pp. 130, illus.; 85c. Isaac Pitman & Sons, New York.

**Transvaal Chamber of Mines,** Annual Report for 1915. 7¼x9½, pp. 300. Transvaal Chamber of Mines, Johannesburg.

**Technology of Marble Quarrying.** By Oliver Bowles. Pp. 174, illus. Bull. 106, U. S. Bureau of Mines, Washington.

**The Physico-Chemical Properties of Steel.** By C. A. Edwards. 6¼x8¾, pp. 229, illus. J. B. Lippincott Co., Philadelphia, Penn.

**Chisana-White River District, Alaska.** By Stephen R. Capps. Pp. 130, illus. Bull. 630, U. S. Geological Survey, Washington.

**Bibliography of North American Geology for 1915, with Subject Index.** By John M. Nickles. Pp. 144. Bull. 645, U. S. Geological Survey, Washington.

**Transactions of the American Institute of Metals.** Vol. IX. Edited by Charles Vickers. 5½x9, pp. 423, illus. American Institute of Metals, Buffalo, N. Y.

**Journal of the Iron and Steel Institute,** Vol. XCIII, No. 1, 1916. Edited by George C. Lloyd, Secretary. 5¼x8¼, pp. 440, illus. Iron and Steel Institute, London.

**Administrative Report of the State Geologist of Virginia for 1914 and 1915.** By Thomas L. Watson. Pp. 45, illus. Virginia Geological Survey, Charlottesville, Va.

**Elements of Mineralogy.** By Frank Rutley. Revised by H. H. Read, with introduction by G. T. Holloway. 4½x7, pp. 394, illus.; $1.25. D. Van Nostrand Co., New York.

**Upper Ordovician Formations in Ontario and Quebec.** By A. F. Foerste. Pp. 279, illus. Memoir 83, Canada Department of Mines, Geological Survey Branch, Ottawa.

**Investigation of the Peat Bogs and Peat Industry of Canada, 1913-14.** By Aleph Anrep. Pp. 185, illus. Bull. 11, Canada Department of Mines, Mines Branch, Ottawa.

**Mining Operations for Gold, Coal, Etc., in the Province of British Columbia, 1915.** Annual Report of the Minister of Mines. Pp. 473, illus. Minister of Mines Office, Victoria, B. C.

**Land and Marine Diesel Engines.** By Giorgio Supino. Translated by A. G. Bremner and James Richardson. 6x8¾, pp. 309, illus. Charles Griffin & Co., Ltd., London, England.

**Contents and Index of the Memoirs of the Geological Survey of India, 1884 to 1911.** Vols. XXI-XXXV. By G. de P. Cotter. 6¾x9½, pp. 119. Geological Survey of India, Calcutta.

**Official Index to State Legislation.** A Cumulative Numerical and Subject Index and a Complete Record of all Bills Introduced in All State Legislatures. 8¼x11, buckram. Law Reporting Co., New York.

**A Textbook of Practical Hydraulics.** For the Use of Mining Schools, Technical Colleges, County and Hydraulic Engineers. By James Park, 5x7½, pp. 284, illus. J. B. Lippincott Co. Philadelphia.

**Petroleum Withdrawals and Restorations Affecting the Public Domain.** By Max W. Ball. Compilation by Lucetta W. Stockbridge. Pp. 427, illus. Bull. 623, U. S. Geological Survey, Washington.

**Report on Mining Operations in the Province of Quebec During 1915.** By Crawford Lindsay and J. A. Bancroft. Pp. 146, illus. Department of Colonization, Mines and Fisheries, Quebec, Canada.

**American Fertilizer Handbook, 1916.** The Standard Reference Book and Directory of the Commercial Fertilizer Industry and Allied Trades. 7½x10½, pp. 368; $1. Ware Bros. Co., Philadelphia, Penn.

**Underground and Surface Water Supplies of Wisconsin.** By Samuel Weidman and Alfred R. Schultz. 6½x9½, pp. 664, illus. Bull. XXXV, Wisconsin Geological and Natural History Survey, Madison, Wis.

**Coal Miners' Pocketbook.** Formerly the Coal and Metal Miners' Pocketbook. Principles, Rules, Formulas and Tables. Eleventh edition, revised and enlarged. 4x6¾, pp. 1172, illus., leather; $4. McGraw-Hill Book Co., New York.

**Harper's Hydraulic Tables** for the Flow of Water in Circular Pipes Under Pressure, Timber Flumes, Open Channels and Egg-Shaped Conduits. By Joseph H. Harper, 4x6¾, pp. 192, illus.; leather; $2. D. Van Nostrand Co., New York.

**Annual Report of the Under Secretary for Mines of Queensland,** Including the Reports of the Wardens, Inspectors of Mines, Government Geologists and Other Officers, for 1915. Pp. 220, illus. Queensland Department of Mines, Brisbane.

**Hydraulic Flow Reviewed.** A Book of Reference of Standard Experiments on Pipes, Channels, Notches, Weirs and Circular Orifices, Together with New Formulas Relating Thereto. By Alfred A. Barnes, 6x9½, pp. 158, illus. Spon & Chamberlain, New York.

**Report of the Sebly Smelter Commission.** By J. A. Holmes, Edward C. Franklin and Ralph A. Gould. Pp. 528, illus. Bull. 98, U. S. Bureau of Mines. Supplied by the Superintendent of Documents, Government Printing Office, Washington, D. C., at $1.25 a copy.

**Zircon, Monazite and Other Minerals Used in the Production of Chemical Compounds Employed in the Manufacture of Lighting Apparatus.** By Joseph Hyde Pratt. Pp. 120, illus. Bull. 25, North Carolina Geological and Economic Survey, Chapel Hill, N. C.

**Annual Report of the Bureau of Mines, Mining and Mine Inspection of the State of Missouri, 1915.** Pp. 182. Bureau of Mines, Mining and Mine Inspection, Mo.

Gives interesting data on accidents, mineral production, lists of mines inspected, etc.

**Transactions of the International Engineering Congress, 1915.** Mining Engineering. Pp. 371, illus. International Engineering Congress, San Francisco, Calif.

Gives the papers on mining presented at the Congress, which was held in San Francisco, Sept. 20-25, 1915.

**Transactions of the International Engineering Congress, 1915.** Metallurgy. Pp. 498, illus. International Engineering Congress, San Francisco, Calif.

Gives the papers on metallurgy presented at the Congress, which was held in San Francisco, Sept. 20-25, 1915.

**Microscopical Determination of the Opaque Minerals.** An Aid to the Study of Ores. By Joseph Murdoch. 6x9, pp. 165, illus.; $2. John Wiley & Sons, New York.

The application of the principles and methods of metallography to the study and identification of ores is of use to geologists and mining engineers. This book was commented upon editorially in the "Journal" of June 17, 1916, on page 1084.

**Leather Belting.** By Robert Thurston Kent. 6x9, pp. 200; $1.50. John Wiley & Sons, New York.

Aside from some typographical errors and occasional carelessness in writing, this book is a good compilation of belting theory as laid down by Taylor and Barth. It is doubtful if the book will appeal to the practical man, however. The treated slack-running belt is completely ignored. The contention throughout is that a certain rather high initial tension is necessary to produce best results, contrary to the recommendations of many experienced belt men. Owing to the present high cost of leather and the successful adoption of substitute belts such as cotton, canvas, rubber, camel hair, etc., space should have been devoted to such belts also despite the title.

**Poor's Manual of Industrials for 1916.** Seventh Annual Number. 6x9, pp. cliii + 3,112; $7.50. Poor's Manual Co., New York.

The regular annual volume of this well-known manual follows the general arrangement of the preceding issue and gives the latest income account and balance sheets of industrial companies, including the large mining companies. It is impossible to say how many pages are devoted to the latter, as they are not given in a separate section. However, the present issue contains about 250 more pages than the 1915 volume, and probably about 500 pages are taken up with strictly mining companies. The general statistical information, which is revised to Aug. 15, is in most cases presented in comparative form, showing at a glance the growth of the business.

**Fatigue Study: A First Step in Motion Study.** By Frank B. and Lillian M. Gilbreth. 5x8, pp. 168, illus., $1.50. Sturgis & Walton Co., New York.

This book is supplementary to, or rather we should say introductory to, the motion study, which is the basis of the Taylor and Gilbreth system of scientific management. To secure the greatest economy in motion, which is the object of that system, we should first find out how the greatest fatigue is produced and the methods by which that fatigue can be lessened and its effects mitigated. To secure this, a fatigue survey is necessary, and this book describes how it should be done, how much fatigue could be eliminated and how it can be in part counteracted or alleviated. To those who are interested in this scientific-management system, this is a necessary part of the course and will be read with much interest.

**Salt in Cheshire.** By Albert F. Calvert. 5½x8½, pp. 1232, illus.; $6.50. Spon & Chamberlain, New York, N. Y.

This elaborate volume claims to be the first connected and full account of the salt deposits of Cheshire, the most important in Great Britain; and we believe the claim is just. The immediate cause of its preparation at this time seems to have been the complex litigation and the appeals to Parliament for legislation, resulting from the surface disturbances and subsidences that have followed the exploitation of the salt deposits for centuries. Salt was made in Cheshire as far back as the year 700 A.D., though it has been only within the past two centuries—and chiefly within 50 years—that the lower strata have been worked on a scale extensive enough to produce the surface disturbances.

The book gives a general account of the geology of the district, the nature, composition and chemistry of the salt deposits and the methods of working them. It then goes at considerable length into the history of the operations and the past and present conditions of the trade. The various companies and associations that have been concerned in the exploitation of the salt and especially the present Salt Union are considered at length, with the legislation affecting the district from time to time. The historical sections include reprints of many old documents and tables of statistics.

It is seldom that so elaborate and complete a work has been compiled in relation to a single district. It is doubtless of great value to those directly connected with the industry. Geologically and historically it leaves nothing to be desired. Only a part of it, however, can be considered of general interest.

**Traité Géneral de Commerce des Minerais et Métaux, Combustibles, Alliages, Engrais, Etc.** By R. Pitaval and L. Ganet. 6x9½, pp. 1,144, illus.; 35 francs. R. Pitaval, Paris.

This volume is, as its name indicates, a general treatise on the production and uses of minerals and metals in common use and also of the rarer elements which are occasionally employed in the making of alloys and for other useful purposes. It is, in short, a volume made somewhat on the plan of "The Mineral Industry" and is intended for commercial as well as for technical use. The different chapters, each on one metal or mineral, give: (1) The production in different countries with notes showing the growth and evolution of that production. (2) The qualities and varieties of the substance under treatment, showing the different products sent to the markets, analyses, effects of impurities upon marketable value and the limits to the exploitation of the mineral. (3) The methods of sale in use in different countries with practical examples. (4) The markets for export and use in countries other than those of production. (5) Quotations and tables of the course of prices, past and present. (6) Uses and outlets for the product.

A supplementary chapter gives much useful information as to freights, facilities for carriage and delivery and the trade in different countries. The volume is introduced by a preface written by M. D. Levat, the eminent engineer and author of a valuable work on the gold-mining industry. He lays especial stress on the importance of the chapter on freights and transportation, which affect so strongly the markets in different parts of the world. Of course, final judgment on a volume like this can be passed only after continued use in practice, but so far as we have been able to examine it, the different articles are well and carefully written and the facts with regards to production, qualities, etc., are carefully and clearly arranged.

**Boston Creek Gold Area and Goodfish Lake Gold Area.** By A. G. Burrows and P. E. Hopkins. Pp. 24, with maps. Bulletin No. 29, Ontario Bureau of Mines, Toronto.

These areas have lately received considerable attention, and development has made some progress. The Boston Creek area is situated about 45 mi. northwesterly from Cobalt and is traversed by the Temiskaming & Northern Ontario Ry. The area in general has an elevation varying from 700 to 1,050 ft. above sea level, and the country is somewhat rugged and broken. The Keewatin rocks have the widest distribution and contain gold-bearing veins. They consist chiefly of greenstones with some volcanic fragmental rocks and iron formation. Gold occurs usually native, but occasionally combined with tellurium, in quartz veins and veinlets in the Keewatin greenstone and later intrusions of granite and porphyry. The geology and mineralogy is in a general way similar to that of the adjoining Swastika, Kirkland Lake and Larder Lake areas, and gold is known to be widely distributed throughout the area. No bullion has as yet been shipped. Prospecting is aided by the excellent transportation facilities.

Goodfish Lake, 1,025 ft. above sea level, is situated 2 mi. northeast of Kirkland Lake in the Larder Lake mining division. A wagon road 9 mi. in length connects it with Swastika, a station on the Temiskaming & Northern Ontario Ry. Considerable prospecting was done during 1915, but when the report was written no work was in progress except at the La Belle Kirkland mine. The Keewatin is the oldest and most dominant of the rocks, consisting of lavas and altered diabases in about equal volume. Cutting these older rocks are dikes, stocks and flow-like masses of granite porphyry. Gold occurs in narrow quartz veins and replacement deposits along the contact of porphyry with other rocks. The veins or stringers are generally an inch or less in thickness, but there may be a series of them forming a lode deposit. Often two or three parallel slip planes coated with quartz and a thin film of molybdenite may form the orebody. Visible gold in a state of fine division occurs in many parts of the area. The cessation of work by many properties would suggest that many of the deposits are low-grade.

## Personals

**W. E. Dunkle** has gone to Seattle, Wash., from Alaska.

**J. C. Fuller**, recently in Cuba, has returned to New York.

**R. Gilman Brown** recently returned to London from Russia.

**R. B. Brinsmade**, recently in St. Louis, has gone to Pueblo, Mexico.

**J. A. Martin**, recently at Santa Rita, N. M., is now at Latouche, Alaska.

**J. Edward Berg** is manager of the Pueblo mine, in Whitehorse copper camp, Southern Yukon.

**H. A. Prosser**, of New York, and **Hugh Wright**, of Spokane, Wash., are now in Valparaiso, Chile.

**J. Frater Taylor** was elected president of the Lake Superior Corporation at the recent annual meeting.

**Edwin E. Chase** and son will be in the Granby District of British Columbia until the end of October.

**Harold C. E. Spence** has returned to Montreal, Canada, after three months spent in Newfoundland and Labrador.

**E. W. Shaw**, petroleum specialist of the Geological Survey, has returned from a business visit to the Tampico region of Mexico.

**Mr. and Mrs. Willard S. Morse** are now at Chuquicamata, Chile; Mr. Morse is connected with the Chile Exploration Co.

**E. O. Ulrich**, paleontologist with the U. S. Geological Survey, has returned from four months' field work in Illinois and New York.

**John Huist**, former chief engineer of the Carnegie Steel Co., has succeeded M. A. Neeland as chief engineer of the Steel Corporation.

**William P. Barba** for 36 years with the Midvale Steel Works in various capacities has resigned his position as vice-president.

**Fred D. Smith**, of Ithaca, N. Y., has taken charge of the leasing and shipping operations on the Arkansaw mine at Landore, Idaho.

**Walter Douglas** and **James French**, of the Phelps, Dodge company, visited and inspected the mines and mills of the Detroit Copper Co. recently.

**D. Foster Hewett**, of the U. S. Geological Survey, writes from Peru that he has completed an examination of the vanadium mines at Minasragras.

**Dr. R. C. Wallace**, of the University of Manitoba, has returned from an inspection of the eastern portion of Manitoba for the Canadian Geological Survey.

**W. M. Brewer** has returned to Victoria, B. C., from the investigation of various mining properties on Vancouver Island on behalf of the British Columbia Department of Mines.

**J. F. McKenzie**, of the International Molybdenum Co., Renfrew, Ont., has been examining the Molly molybdenite mine, on Lost Creek, Nelson mining division, British Columbia.

**Carl H. Beal**, a graduate of Stanford University, has joined the petroleum force of the Bureau of Mines. Mr. Beal has been doing technical work in Oklahoma for the past two years.

**E. E. Slick**, general manager of the Cambria Steel Co. has been chosen a vice-president of the Midvale Steel and Ordnance Co., and will have charge of the operation of the various works.

**M. A. Neeland**, assistant to the vice-president and chief engineer of the United States Steel Corporation, has resigned to become consulting engineer of the American International Corporation.

**Prof. James F. Kemp**, head of the department of geology of Columbia University, has much improved in health. The trustees of the university have, however, granted him a further leave of absence for one year.

**John Johnston**, who has been connected with the Geophysical Laboratory of the Carnegie Institute, has resigned to accept a position on the technical staff of the American Zinc, Lead and Smelting Co., in the Joplin district.

**H. D. McCaskey**, chief of the mineral resource division of the Geological Survey, is on a trip of inspection and investigation on the Pacific coast. He will investigate several of the quicksilver deposits in that portion of the country.

**W. M. Archibald**, head engineer for the Consolidated Mining & Smelting Co., of Canada is to have charge of development on the Old Sport and Merry Widow groups in the Quatsino district, Vancouver, Island. These properties were recently secured by the Coast Copper Co.

**The Arizona Delegates** to the American Mining Congress, as appointed by the governor, are C. E. Addams, Ray; C. E. Mills, Miami; Capt. John C. Greenway, Warren; B. Britton Gottsberger, Miami; P. G. Beckett, Globe; J. W. Bennie, Clifton; Edward R. Oliver, Payson; John D. Burgess, Tucson; Van H. Brooks, Casa Grande.

**H. H. Johnstone**, for some years head underground boss in the Consolidated Mining and Smelting Co.'s Center Star-War Eagle group of mines at Rossland, B. C., after having for the last three months been acting district inspector of mines during the absence on sick leave of Inspector Jas. McGregor, has been added to the permanent mine-inspection staff of the British Columbia Department of Mines.

**Edwin Higgins**, having severed official connection with the U. S. Bureau of Mines, and the California Industrial Accident Commission, by resignation effective Nov. 1, announces his association with a number of California Mining companies and the California Metal Producers' Association as consulting safety and efficiency engineer. His permanent address is the Merchants National Bank Bldg., San Francisco.

**A. C. Garde**, formerly manager of the Payne mine, in Slocan district of British Columbia, and for several recent years having his headquarters at Prince Rupert, the western terminus of the Grand Trunk Pacific, left the latter place on Sept. 5 for Smithers, in Omineca division and near the railway, to take charge of the development of a mining property on which the occurrence of silver-lead and antimony ore has been reported.

## Societies

**Colorado Scientific Society** held its first meeting of the new year in Denver, Oct. 7, and discussed the abolition of the apex law and extra-lateral rights. Speaking affirmatively for this end were George E. Collins, E. C. Stimson and Henry May, while the chief opponent in the debate was George Manley, dean of the law school of Denver University. The affirmative appeared to win, although this was not conducted as a set debate.

**Franklin Institute, Philadelphia**, has arranged a program of lectures for the winter of 1916-17, included in which are the following:

Oct. 18, 1916—"Scientific Research in Relation to the Industries," by Charles P. Steinmetz.

Dec. 14, 1916—"The Cooling of Water for Power Plant Purposes," by C. C. Thomas.

Feb. 1, 1917—"The By-Product Coking Industry," by C. J. Ramsburg.

March 1, 1917—"Development and Progress in Aviation Motors," by Henry Souther.

March 15, 1917—"Design, Construction and Equipment of a Modern Military Aeroplane," by Jerome C. Hunsaker.

**American Electrochemical Society**—The 30th general meeting of the American Electrochemical Society was held in New York from Sept. 27 to 30, inclusive. The program included the following papers: "Atmospheric Corrosion of Commercial Sheet Iron," by E. A. and L. T. Richardson; "The Electrolytic Recovery of Lead from Brine Leaches." by O. C. Ralston and C. E. Sims; "Electrolytic Zinc Dust," by H. J. Morgan and O. C. Ralston; "Electrolysis of Vanadium Salts," by S. Fischer; "High Temperature Heat Developed during Electrolysis," by Carl Hering; and "The Possibilities of Developing Super-refractory Materials for Incandescent Lighting," by F. A. Fahrenwald. The social side of the convention was not forgotten, provision being made for amusement and shopping tours for the wives of the visiting chemists. A smoker for the men was held, attended by 800 to 900 chemists and a scenic trip up the Hudson on Sept. 30 concluded the meeting.

**American Iron and Steel Institute**—The eleventh general meeting will be held at the Planters' Hotel, St. Louis, Oct. 27 and 28. Friday will be devoted, as usual, to the reading and discussion of papers. The banquet will be held on Friday evening at the Club House of the Missouri Athletic Association, not far from the Planters'. The Local Committee is preparing an attractive program for "Seeing St. Louis" on Saturday. The following is a tentative list of the papers and addresses:

President's Address, by Elbert H. Gary.

"St. Louis and Its Industries," by Clarence H. Howard, St. Louis.

"The Duplex Process," by George B. Waterhouse, Buffalo, N. Y.

"Pulverized Coal as a Fuel for Metallurgical Furnaces," by James W. Fuller, Allentown, Penn.

"The Iron Ores of the Adirondack Region," by Frank S. Witherbee, New York.

"Progress in Hot Blast Stove Design," by Arthur J. Boynton, Lorain, Ohio.

## Industrial News

**George A. Muir** has recently been made manager of the mining machinery department of the Mine & Smelter Supply Co. with headquarters in Denver.

**P. H. Reardon** has severed his connection with the General Machinery and Supply Co., San Francisco, Calif., having disposed of his interest to his associates. Joseph A. Buckley succeeds Mr. Reardon as president, A. L. Green is vice-president and H. F. Jurs, manager.

**McFarlane-Eggers Machinery Co.** has been organized with headquarters at 28th and Blake St., Denver, Colo. The company has taken over the business of Peter McFarlane & Sons Iron Works, and will manufacture a general line of mining machinery. Henry Eggers, formerly manager of the mining-machinery department of the Mine and Smelter Supply Co., is president, and Frederick McFarlane is secretary and treasurer.

## New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

CLASSIFIER and Dewaterer. Walker J. Boudwin, Salt Lake City, Utah, assignor to the General Engineering Co., Salt Lake City, Utah. (U. S. No. 1,201,014, Oct. 10, 1916.)

HOIST—Electrically Operated Hoist. Fred L. Stone, Schenectady, N. Y., assignor to General Electric Co. (U. S. No. 1,200,264; Oct. 3, 1916.)

HOISTING and Conveying Means. Merian H. Dickinson, Seattle, Wash., assignor to Lidgerwood Manufacturing Co., New York, N. Y. (U. S. No. 1,200,712; Oct. 10, 1916.)

LEACHING—Apparatus for Extracting Metals From Their Ores. John C. Greenway, Warren, Ariz. (U. S. No. 1,200,832; Oct. 10, 1916.)

LEACHING — Process of Recovering Copper From Solution. George A. Schroter, Denver, Colo., and William C. Laughlin, Nogales, Ariz. (U. S. No. 1,200,534; Oct. 10, 1916.)

MINE CAR. Warren V. Johnson, Bloomsburg, Penn., assignor to American Car and Foundry Co., St. Louis, Mo. (U. S. No. 1,199,794; Oct. 3, 1916.)

MINE-CAR WHEEL — Capped-Hub Mine-Car Wheel. Ernest M. Hicks, Berwick, Penn., assignor to American Car and Foundry Co., St. Louis, Mo. (U. S. No. 1,199,789; Oct. 3, 1916.)

NITRIC ACID—Process for the Production of Nitric Acid From Nitrous Gases. Antonius Foss, Christiania, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway. (U. S. No. 1,200,334; Oct. 3, 1916.)

POTASSIUM—Process of Obtaining Alkali-Metal Compound From Silicates. Walter August Schmidt, Los Angeles, Calif., assignor to International Precipitation Co., Los Angeles, Calif. (U. S. No. 1,200,887; Oct. 10, 1916).

REGENERATIVE FURNACE. Horace E. Smythe, Pittsburgh, Penn., assignor to The S. R. Smythe Co., Pittsburgh, Penn. (U. S. No. 1,188,502; June 27, 1916.)

SCREEN—Wet-Screen. Maurice Peterson, Park City, Utah. (U. S. No. 1,199,300; Sept. 26, 1916.)

SEPARATION—Apparatus for Separating Coal, Ore, Etc. Frank Pardee, Hazleton, Penn. (U. S. No. 1,197,946; Sept. 12, 1916.)

SEPARATION—Method and Apparatus for Separating Minerals and Metals. John Fred. Hedman, Los Angeles, Calif., assignor of one-half to Thomas Spaulding, Los Angeles, Calif. (U. S. No. 1, 198,126; Sept. 12, 1916.)

SILICATES—Method of Treating Mineral Silicates. Joseph C. W. Frazer. William W. Holland and Ellis Miller, Baltimore, Md. (U. S. No. 1,196,734; Aug. 29, 1916.)

STEEL—Manufacture of Steel by the Basic Open-Hearth Process. Alfred Ernest Davies, Bilston, England. (U. S. No. 1,198,827; Sept. 19, 1916.)

STEEL FURNACE. Joseph L. Dixon, Detroit, Mich. (U. S. No. 1,198,626; Sept. 19, 1916.)

TRANSFORMER—Electric Transformer and Welding, Smelting and Like Apparatus. Richard Mack, Neu-Tempelhof, near Berlin, Germany. (U. S. No. 1,199,092; Sept. 26, 1916.)

## Assessments

| Company | Delinq. | Sale | Amt. |
|---|---|---|---|
| Alpha, Nev. | Oct. 25 | Nov. 15 | $0.03 |
| Andes, Nev. | Oct. 11 | Nov. 1 | 0.02 |
| Blue Bell, Ida. | Oct. 9 | Nov. 9 | 0.002 |
| Blue Bull, Nev. | Oct. 16 | Nov. 20 | 0.01 |
| Blue Star, Ida. | Sept. 25 | Nov. 21 | 0.02 |
| Cedar Creek, Ida. | Oct. 23 | Nov. 23 | 0.01 |
| Chief Cons. Ext., Utah. | Oct. 10 | Nov. 1 | 0.002 |
| Cornet, Ida. | Oct. 20 | Nov. 20 | 0.00075 |
| Consolidated Imperial, Nev. | Oct. 25 | Nov. 15 | 0.01 |
| Demijohn, Utah. | Oct. 21 | Nov. 10 | 0.005 |
| Diam. Blk., Butte, Nev. | Oct. 12 | Nov. 18 | 0.01 |
| Diamondfield Bl'k B'tte, Nev. | Oct. 12 | Nov. 18 | 0.01 |
| Duluth, Ida. | Oct. 18 | Nov. 18 | 0.001 |
| Eagle Mountain, Ida. | Oct. 2 | Nov. 4 | 0.001 |
| Enterprise, Ida. | Oct. 19 | Nov. 20 | 0.002 |
| Four Timber, Ida. | Oct. 1 | Nov. 1 | 0.002 |
| Friend, Ida. | Oct. 21 | Nov. 24 | 0.002 |
| Giant, Ida. | Oct. 5 | Nov. 9 | 0.003 |
| Hale and Norcross, Nev. | Nov. 8 | Nov. 20 | 0.03 |
| Idaho & L. A., Ida. | Oct. 16 | Nov. 17 | 0.005 |
| Idaho Mont, Ida. | Oct. 30 | Nov. 18 | 0.002 |
| Independent, Ida. | Oct. 7 | Nov. 7 | 0.005 |
| Manhattan Cons., Nev. | Oct. 9 | Nov. 8 | 0.01 |
| Military, Ida. | Oct. 25 | Nov. 25 | 0.00025 |
| Monarch-Pgh., Nev. | Oct. 23 | Nov. 23 | 0.01 |
| Murray Copper, Utah. | Oct. 9 | Nov. 8 | 0.001 |
| Naildriver, Utah. | Nov. 4 | Dec. 4 | 0.01 |
| Ninemile, Ida. | Nov. 2 | Nov. 17 | 0.0015 |
| Nonpareil, Ida. | Oct. 23 | Nov. 23 | 0.001 |
| North Franklin, Ida. | June 19 | Nov. 23 | 0.005 |
| North Tintic, Utah. | Oct. 10 | Nov. 1 | 0.002 |
| Ophir, Nev. | Oct. 25 | Nov. 15 | 0.05 |
| Raven, Ida. | Oct. 23 | Nov. 20 | 0.001 |
| Seg. Belcher, Nev. | Oct. 30 | Nov. 24 | 0.02 |
| Selma, Utah. | Nov. 4 | Nov. 23 | 0.005 |
| Sierra Nevada, Nev. | Oct. 12 | Nov. 2 | 0.10 |
| Silver Mt., Ida. | Oct. 21 | Nov. 24 | 0.002 |
| Spearhead, Nev. | Oct. 2 | Nov. 2 | 0.01 |
| Tarbox, Mont. | Sept. 28 | Oct. 28 | 0.005 |
| Tobar, Utah. | Nov. 2 | Nov. 23 | 0.002 |
| Tyler, Ida. | Oct. 12 | Nov. 13 | 0.0015 |

# Editorial Correspondence

### JACKSON, CALIF.—Oct. 16
(By Telegraph)

**State Labor Commissioner's Proposal** that the mine managers take back strikers and pay an advanced wage to worthy men at the end of three months rejected by the managers, who will resume work if the men return on the old wage scale. The managers say they have nothing to arbitrate or discuss. The South Eureka and Central Eureka are guarded while pumping water but no serious outbreak has yet occurred.

### BUTTE—Oct. 15

**Butte & London Mine,** which is being developed by the Rainbow Development Co., is beginning to look up. A vein, assaying 8 oz. silver to the ton for a width of 10 ft., has been encountered in the south crosscut on the 1,600 level. The vein also carries some gold and copper. It is one of seven veins cut on the 1,600-ft. level.

**Butte Copper & Zinc Co.'s** Emma mine, operated by the Anaconda company, is shipping high-grade ore to the concentrator at Anaconda at the rate of 150 tons per day. The assays of the ore average 37½% zinc, 6% lead, and 10½ oz. silver. The Emma is one of the principal sources of supply for the new zinc concentrator at Anaconda and the zinc refinery at Great Falls. The Douglas mine in the Coeur d'Alene district is also furnishing about 100 tons of zinc ore per day.

**Douglas Mining Co. Stockholders** will hold a meeting Nov. 1 for the purpose of ratifying the action of the directors in selling the property of the company, situated in the Cœur d'Alene district of Idaho, to the Anaconda company for $256,050. It is to be an outright sale and the Douglas stockholders will get their proportion of the price. The Douglas company is capitalized for $1,200,000. The option which the Anaconda company took on the Douglas has still about five months to run. Meanwhile the Anaconda company is doing extensive development work on the property and is shipping ore to the Washoe concentrator and is paying the Douglas company a royalty of $3 a ton on the ore taken out. The Douglas has a good vein of zinc ore, but it is not phenomenal.

**U. S. Mine Rescue Station Officers** of the newly created mine-rescue station have established official headquarters at the School of Mines building where hereafter all the business of the station will be transacted. It has been announced that six engineers and other mine-rescue experts will be in charge of the mine-rescue car that is to be equipped with the most uptodate appliances for rescue and first-aid work. The payroll for this Federal service will amount to nearly $25,000 a year and, with local purchase of supplies, the department's total expenditure in Butte, it is said, will reach from $30,000 to $35,000 a year. Dr. W. A. Lynott, a surgeon of the U. S. Bureau of Mines, is instructing the first-aid classes of the Butte mines and will hold several lectures on the subject to which the general public is invited. Dr. A. J. Lanza, of the U. S. Health Service, and Daniel Harrington of the Bureau of Mines, are at present in charge of the office at the School of Mines. The movement is expected to offer special advantages to the students of the School of Mines who will be in close touch with the activities of the station and receive special training in rescue and first-aid work.

**Industrial Workers of the World** invaded Butte and under some pretense or other secured a permit from the city clerk for the use of the City Auditorium. During the day detectives arrested two of the members carrying banners through the streets of Butte, announcing a meeting at the Auditorium and distributing posters which read as follows: "Fellow Workers—Come and do your duty. Open the jail doors or we will close the factories and mines. We fight for the freedom of those who dare to fight for us. Many Industrial Workers of the World organizers and strikers are jailed in the mining range. Speakers today in several languages. We do not want Russian methods." The police promptly took the matter in hand and when a crowd appeared at the Auditorium to attend the announced meeting, it was dispersed with some difficulty and members of the police force were met with threats. The number of Industrial Workers of the World members in Butte has increased in the last few weeks and has materially swelled the list of unemployed and unemployable that have swarmed into Butte, attracted by the high wages and the widely advertised prosperity of the town. In spite of the feverish activity prevailing in and about Butte in all lines of industry, the supply of workers now far exceeds the demand and Butte at this moment offers no inducement to the jobless, flocking to the city from every direction.

### DENVER—Oct. 14

**Denver Civic and Commercial Association** proposes a mining bureau that will coöperate with similar bureaus in the Rocky Mountain region in a campaign to secure more recognition, from the Federal officials, of the assistance needed to develop properly the mineral resources. This proposed action is largely due to the withdrawals of so many large areas of mineral-bearing ground from location and entry. Fred Carroll, state commissioner of mines, has been requested to name delegates who will advocate the proposed measures at the forthcoming session of the American Mining Congress.

### LEADVILLE, COLO.—Oct. 14

**The Down Town Mines Co.** has undertaken the extensive development of the drained territory accessible through the Penrose shaft. In the upper levels, the uncovering of several bodies of payable ore are reported but development has not reached a stage from which the exact value and importance of the discoveries can be learned. The opening of a large body of iron-manganese is practically assured by the work now in progress, but as yet no ore has been hoisted for shipping. The water in the property is now completely under control with the pumps throwing 2,500 gal. per min. to surface. The flow is reported to be falling off gradually as the ground slowly drains.

**Strike Agitation** pro and con is causing considerable uneasiness in the district. The Leadville branch of the Western Federation of Miners has filed with the State Industrial Commission a notice that a demand has been made on the operators for a wage increase to $3.75 and $4.25 per day. Union officials are busy organizing the miners and apparently intend attempting the achievement of recognition of the union and higher wages. No uniform increase throughout the district is possible, the operators claim. The profit margin on most of the ore output is claimed to be less than $1 per ton, and a great deal of it nets around 25c. per ton. The proposed increase from the $3.30 per day now paid would enforce the closing down of many low-grade mines and throw several hundred men out of work.

**Leadville Unit** plans have been altered in that it has been decided to sink the Jamie Lee shaft instead of the Harvard. The draining of the Fryer Hill basin to a depth of 407 ft. was accomplished through the Harvard, thereby unwatering the Jamie Lee and other shafts under the control of the United States Smelting, Refining and Exploration Co. The pumping machinery will remain in the Harvard and a large compressing plant is being installed at the same property. Hoisting machinery has been ordered for the Jamie Lee and sinking 300 ft. will be undertaken as soon as the shaft can be equipped. Several bodies of sulphide and carbonate ores have been uncovered in the Tip Top and other properties controlled by the Leadville Unit and a steady tonnage is being extracted. Indications uncovered through systematic sampling of old workings by a large force of men are reported to be highly satisfactory. Geological sections of the entire property controlled by the company are being made, a work that is proving of great value in planning the development.

### SALT LAKE CITY—Oct. 13

**Amendment of Utah Constitution** to be voted upon at the general election Nov. 7, involves sweeping changes in the constitutional provisions for the taxation of mines. The present method of assessing mining property in the state is to assess surface ground of patented claims at the price paid the government, machinery and surface improvements at their value, and net annual proceeds at their value. The amendment proposes to multiply net proceeds of all mines three times for purposes of taxation, and to permit the taxing authorities to place their own valuation on the surface ground of nonmetalliferous mines. The proposed amendment repeals a present requirement that taxation shall be uniform and equal on all classes of property in the state and permits the classification of property for taxation, and the application of differing rates to various classes. It also permits the taxation of the shares of any company in addition to the taxation of the property represented. The proposed amendment is being vigorously resisted by mining, manufacturing and other business interests of the state. The Utah chapter of the American Mining Congress has become active in the matter and is sending literature on the subject to tax payers of the state. The proposed multiplication of mine proceeds for taxation is being urged by the taxing officers of the state on the ground that as mine proceeds have always been taxed at 100% valuation, while other property has been taxed at from 18% to 50% of its value, the valuation on mine proceeds should be increased in the same ratio as the increase on other classes of property which are being assessed at full value this year for the first time. The mining intersts naturally oppose this, contending that it would legalize and perpetuate an injustice through which the producing mines have suffered ever since statehood was achieved.

**The Deep Creek Section** or Clifton mining district in western Tooele County, one of the promising, but relatively little developed mineral areas of the state, is to have a railroad. Articles of incorporation of the Deep Creek Railroad Co., a Utah corporation, were filed recently. The company is capitalized at $450,000, all common stock, a large part of which has been subscribed by local men. There are no bonds, bonuses, or promotion stock. The company will build a line from Wendover on the Western Pacific, 119 mi. west of Salt Lake, south to Gold Hill, a distance of 44 mi. All of the material for the railroad has been purchased, and the contract for the grading and laying of track has been given to the Utah Construction Co.—work to be started at once. The officers are: Duncan MacVichie, a large owner in the Western Utah Copper, at Deep Creek, and through whose efforts the railroad was undertaken, president; T. W. Wiche, chief engineer of the Western Pacific R.R., vice-president; W. W. Armstrong, of the National Copper bank of Salt Lake City, treasurer; C. M. Levy, president of the Western Pacific R.R., director; E. O. Howard, Walker Bros., bankers, Salt Lake, director; Edmund T. Jones, and Harold R. Smoot, additional directors. Terminal arrangements have been made with the Western Pacific at Wendover. This company is naturally interested in the undertaking, on account of increased freights, etc. The Clifton mining district is 14 mi. long, north and south, by five miles east and west, so far as the mineralized area is at present known. Most of the properties are but partly developed, owing largely to the high cost of fuel and supplies. Heretofore everything had to be hauled by wagon road, 56 mi., at a cost of $12 and upward per ton. The roads were bad the greater part of the time. The new railroad running nearly due south, will cut across the west side of the Great Salt Lake desert and reduce the distance to 44 mi. to Gold Hill at the terminus. The principal property of the district is the Western Utah Copper, which has done more development than any other and is reported to have 100,000 tons of copper ore blocked out, assaying 4 to 5% copper and carrying gold and silver. This mine also has carbonate lead ores in another deposit, carrying about 15% lead and 12 oz. silver. Other properties more or less developed, are the Bamberger properties, the Ida Lull, etc., copper; the Cane Springs, gold-copper; the Alvarado, gold-copper; the Calavaras, gold, owned by the Western Utah Copper; the Gardener properties on Dutch Mountain, 35 mi. from Wendover, copper-gold; the Rodenhouse and Wilson Brothers properties at Gold Hill, and others. Bismuth and gold ore has been shipped from one of the Wilson properties. Altogether there are 27 mines and prospects. Irrigable lands in Deep Creek and neighboring valleys will be tapped by the new line. The railroad will cause much development to be done in this district, which will add to the mineral output of the state.

**Changes in Tintic Power Lines** are being made by the Utah Power and Light Co. The new work at Homansville in the northeastern part of the district has caused a change to be made from a 5,000- to an 11,000-volt line. The Topliff limestone quarries of the United States Smelting Co. and those of the American Smelting and Refining Co., which for some time have been supplied by a 44,000-volt line—formerly a part of the old Mercur system of the power company—are to be served in the future by the reconstructed line, carrying 11,000 volts.

### MIDAS, NEV.—Oct. 14

**Discovery of Cinnabar** not far from the Gold Circle district is providing plenty of excitement. From all reports received so far, the discovery is apt to prove of considerable dimensions. Outcrops have been traced for 5 to 6 mi. and the surface width is said to be from 10 to 40 ft. Some large pieces of float have been found on the adjacent country and are reported to carry a high percentage of mercury.

### JOPLIN, MO.—Oct. 14

**A Record Sale Involving $30,000** for a 30-acre lease only partially developed was recorded here last week, the Merchants Mining Co. of Com-

merce, Okla., being at the selling end of the deal. The buyers have not been made public, but are said to be Eastern investors. The transaction is significant of the popularity of the Oklahoma section of the Joplin district at this time. More than a hundred drills are operating in this section, blocking out new ore runs. New companies are being formed daily, and new leases taken. The Picher company, which started the development of this field, is just now getting started at production in a thorough manner and is turning out, with its five mills at Picher, not far from 300 tons of concentrates weekly, and its plants are not yet running at full capacity. The Admiralty Zinc Co. is also getting its mills in steady operation and a score or more of smaller companies are getting into the producing list. It now appears that in a short time this section of the district will rival in ouput the sheet ground district at Webb City-Carterville, and it is claimed that ore will be mined in Oklahoma profitably when the lean ore mines in other parts of the field are forced to close down, on account of the superior richness of the dirt.

### ST. LOUIS, MO.—Oct. 14

**National Lead Co.** has purchased the Jackson tract west of Bonne Terre for $60,000, and 640-acre Pine tract near Elvins for $176,000, where the lead is about 900 ft. deep—the deepest in the district.

**Drilling Is Being Pushed** along the Big River in Washington County, near Irondale, by two New York men. It is reported some excellent cores are being obtained. Local men are also drilling near Hughes Mountain, in Washington County, near the porphyry contact.

**North American Mill** at Fredericktown is being remodeled and will soon be in operation after several years' shutdown. It is reported that the Schulte lands, where some good lead and nickel sulphides were found with the diamond drill years ago, have been taken over.

**Jones Shaft at Elvins** is nearly completed, but a heavy water flow has been struck at 525 ft. that is making it very difficult to continue the work. A steam pump is being installed with a capacity of 2,000 gal. per min. It is hoped this will enable the shaft to be bottomed at about 560 ft., which will carry it under the rich ore said to occur on this 40-acre tract.

**More Lawsuits Brought by Farmers** living along Big River bottoms against St. Francois County lead mining companies are impending. The old trouble of slimes overflowing and damaging farm lands during freshets is again the bone of contention. Some of the companies are building large settling ponds to eliminate the trouble—but they are not moving fast enough to suit the farmers.

**Einstein Mine,** in Madison County, is being reopened by Ladenburg, Thalmann & Co., of 25 Broad St., New York, and a new 100-ton mill is under construction to treat tungsten ore. This occurs as wolframite in a narrow fissure vein in granite that was first worked for its argentiferous galena many years ago. At that time a smeltery, mill, hotel and miners' houses were erected, and an expensive granite dam thrown across the St. Francois River. Several cars of lead ore, assaying from 20 to 100 oz. silver per ton, were shipped, but the heavy tungsten, then regarded as bothersome gangue rock, was wasted.

### DULUTH, MINN.—Oct. 14

**M. A. Hanna Co. Has a Drilling Crew** busy on exploratory work in the Round Lake district, 7 mi. east of Hayward, Wis. The company has options on many tracts of land in the neighborhood. Local rumors state that a considerable tonnage of ore has been developed. The district is a new one.

**Successful Bidder for Ore Dock No. 6** of the Duluth, Missabe & Northern R.R. was the Barnett & Record Co., of Duluth. The dock is to be built at West Duluth, replacing No. 2 Dock, a wooden structure now being dismantled. The contract calls for 29,000 cu.yd. of concrete to be placed on wooden piling. The new dock will be 2,300 ft. long, with 384 pockets of 300 tons capacity each. The American Bridge Co. has the contract for structural work.

**A Municipal Lighting Plant** is the latest frill demanded at Hibbing. Village officials have requested bids on a plant to cost between $300,000 and $500,000. The mining companies, who pay practically all the village taxes, have entered a vigorous protest, claiming that the purchase of current from the Great Northern Power Co. would be much cheaper. In line with previous practices in "the richest village on earth," the plant will probably be built. The proposed site is situated over a considerable orebody, adjacent to the Sellers and Mahoning mines.

**Contract for a $100,000 Clubhouse** has been let to Lounsberry-McLeod Co. It will be built at Morgan Park for employees of the Minnesota Steel and Universal Portland Cement companies. The building will be of concrete and stucco construction with pressed brick trimming, size 100x150, three stories and basement, fireproof throughout. Some features are, a large swimming pool, lounging room, shower baths, auditorium, reading rooms and a dormitory for employees of the two companies. The three-acre tract surrounding the building will be laid out in tennis courts, track, etc. The same company has a contract for 40 additional dwellings to be erected in Morgan Park.

### TORONTO—Oct. 14

**Discovery of Iron Ore,** of high quality, is reported to have been made on one of the uncharted islands off the East Coast of James Bay. A prospecting party, headed by Alex. A. Gemmell, of Toronto, has staked 4,000 acres which it is claimed cover almost continuous iron-ore deposits, including a dike running 7 mi. with a width of from 40 to 60 ft. The ore is said to carry 50% metallic iron with about 0.5% phosphorus. An open harbor close to the deposit will furnish good transportation facilities. The Ontario Bureau of Mines has asked to have samples forwarded for analysis.

**A Zinc Deposit in Nova Scotia**—reported to be of unusual richness—has been acquired by Toronto men, represented by F. C. Sutherland & Co., of Toronto. The deposit is in Cape Breton, N. S., about 30 mi. northwest of North Sydney. The ore formation is reported wide and traceable for a long distance. Selected samples assay as high as 34% zinc, 2½ to 4½% copper, 10% lead and some old and silver. Another outcrop of less width has been followed for 1,000 ft. and is also reported to carry high zinc, with some lead and copper. H. H. Sutherland has gone East to complete arrangements for the development of the property on an extensive scale. The owners have been offered contracts for large quantities of zinc, lead and copper and have planned operations with a view of making heavy shipments at the earliest opportunity. The property is situated within 4 mi. of a good harbor and within 15 mi. of coal.

# The Mining News

## ALASKA

ALASKA MINES CORPORATION (Nome)—Construction of steel and concrete machine shop begun; first of kind in Nome field. Will be used in assembling two new 15-cu.ft. bucket dredges during 1917.

VALDEZ CREEK PLACER (Valdez)—Report received at Boston office from Manager Pierre Bouery, says details of efficient mining worked out and plant now ready for placering. Ditch capacity considerably increased and now has 3,500 in. water always available.

## ARIZONA

### Cochise County

TWO PEAKS MINING CO. (Turner)—New copper-mining company incorporated to develop 750 acres in Whetstone Mountains, 20 mi. west of Tombstone.

### Gila County

AMERICAN ORES AND ASBESTOS (Globe)—Opened asbestos deposit on Cherry Creek in Sierra Ancha Mountains; production for 18 months contracted to Philadelphia manufacturers.

MIAMI CONSOLIDATED MINES (Miami)—New organization to develop 1,200 acres of ground adjoining Live Oak and Keystone areas of Inspiration on southwest; capitalized at $2,500,000; John S. Cook, Globe, and Louis Lefkovitz, Miami, incorporators.

### Greenlee County

ARIZONA COPPER (Clifton)—September production, 2,090 short tons copper.

### Mohave County

ARIZONA ORE REDUCTION (Chloride)—New 150-ton reduction plant in process of erection to use complex-ore process invented by George F. Goerner; plans to turn out bullion by Jan. 1.

BLACK RANGE (Oatman)—Road building surface excavation reported as uncovering quartz vein for 200 ft., several feet wide, assaying about $23 per ton. Strike made near old shaft from which drift will run at 150-ft. depth to tap orebody.

### Pinal County

MAGMA COPPER (Superior)—New zinc mill will operate soon; ore will come from recently struck body on 1,200-ft. level, sampling 7% zinc, 48 oz. silver, $1.40 gold, and 1¼% copper.

ARIZONA RAY COPPER (Ray)—New organization of Los Angeles and Oatman mining men to develop large tract adjoining both Ray Consolidated and Ray Hercules; Edmund L. Hiatt, superintendent.

### Yavapai County

PLACER MINING IN KIRKLAND DISTRICT revived by optioning of claims along Hassayampa Creek by Colorado men—dredge construction contemplated.

OCTAVE (Prescott)—Plans to resume milling; new orebody being blocked out on 1,200-ft. level.

JEROME DAISY (Jerome)—Constructing trail from Arkansas & Arizona; camp building and sinking of shaft will begin soon.

LUCKY STRIKE (Kirkland)—Recently incorporated to work Stein Copper Co. properties—will commence work soon. Planned to push development on extensive scale.

CONSOLIDATED ARIZONA (Humboldt)—September production 1,170,000 lb. copper, largest in company history. Smeltery, damaged by fire last summer, now repaired.

PITTSBURG JEROME COPPER (Jerome)—Power transmission line completed. Hoisting and shaft sinking equipment delivered. Ten power drills expected to supplant present three by Oct. 20.

McMAHAN (Kirkland)—Will resume development, Nov. 1. During operation ending last May owing to expiration of contract for sale of ore to smeltery, ore shipments from development work assayed 4.2 to 17% copper. Property has large tonnage low-grade on surface assaying 1 to 3% copper.

## CALIFORNIA

### Amador County

KENNEDY (Sutter Creek)—Two new boilers being installed. Raising tailing dam to additional height of 25 ft. nearing completion.

KEYSTONE (Sutter Creek)—Mine and mill closed for 60 days for annual repairs. Mine not affected by labor strike, as men were receiving additional 25c. a day as premium for advancing development and extraction.

CONSOLIDATED AMADOR (Sutter Creek)—New sawmill completed, equipped with modern machinery for sawing and framing mine timbers; tracks being laid from mill to collar of shaft. Grading under way for new steel hoist. Unwatering shaft progressing steadily; below 500 level more care and less speed necessary because of bad condition of old timbers. Expected to complete unwatering by end of present year. Labor strike does not interfere; character of skilled labor required, receiving larger pay than usual operation, exempted this mine from demands made by labor union.

CENTRAL EUREKA (Sutter Creek)—Mill closed down and only work done is keeping water out of shaft and drifts. Following labor strike mill ran on ore remaining in bins and this now exhausted. Mine did not pay in September, because of development of new orebodies. During month, 223 ft. of drifts and raises were driven and 2,646 tons ore crushed. Costs for the month totaled $13,367, receipts being $9,063. Ore averaged $3.38 per ton. Recent geological examination by Mr. Julian indicated existence of new orebodies that were being explored when labor strike caused management to close down with other Mother Lode mines.

### Calaveras County

CALAVERAS CONSOLIDATED (Melones)—Development progressing steadily and satisfactorily, disclosing oreshoot 300 ft. long and wider than tunnel. Discovery made at 1,000-ft. point from portal. Recent record shows advance of 28 ft. in 48 hr. in tunnel driving. W. J. Loring, general manager; J. A. Davis, superintendent.

### Inyo County

DARWIN LEAD-SILVER (Darwin)—Has applied for listing stock on New York Curb. Company has 300,000 authorized shares, par value, $5; 70,000 in treasury.

### Nevada County

PRUDENTIAL & NORAMBAGUA (Grass Valley)—Properties taken under bond and purchase option by San Francisco and Eastern men represented by F. M. Shideler, of San Francisco, and Frank L. Rodgers, of Connecticut. Both properties said to have good ore. Prudential opened to depth of about 1,000 ft., equipped with mill and some mining machinery.

### Plumas County

CLEGHORN BAR, on middle fork of Feather River, containing about 50 acres of placer ground, worked in early days in a crude way, has been disposed of to Oakland men represented by George C. Richards, mining engineer. J. W. Egbert and William Metcalf were owners.

DIVING EQUIPMENT received at Quincy for installation on middle fork of Feather River by Robinson & Becker, of Toll Gate, consists of

gas engine, dynamo, air compressor, diving suits and other essential apparatus. Situation is above Hartman Bar. As there is fall of 4,000 ft. in elevation in distance of 2 mi., expected that difficulty will be met in placing machinery, which will be lowered by cables.

### Shasta County

POTOSI (Redding)—Property 6 mi. west of Redding, idle since 1871, being opened up under superintendency of A. S. Howe. Property belonged to late Senator J. P. Jones, of Nevada.

### Tuolumne County

DUTCH-APP-SWEENY (Jamestown)—W. J. Loring, manager, just returned from Boston, is preparing for installation of Minerals Separation flotation plant. Development of App during winter expected to be followed by installation of a modern mill.

## COLORADO

### Boulder County

GILLESPIE (Sunset)—Property being developed by Neighbor & Harris under lease. Payable ore opened; concentrates from milling tests assay 4 oz. gold and 200 oz. silver a ton.

WHITE RAVEN (Ward)—Rich silver ore pocket opened on 340-ft. level. New Leyner compressor installed and additional machine drilling equipment will be purchased. Extensive development work under way. Vein of lead ore opened on White Raven Extension. Frank Davis, manager.

COLD SPRING (Nederland)—Actively developed by Hinman Brothers. Shaft being sunk to 400-ft. level. Leyner drill sharpener installed. Several pockets high-grade tungsten ore opened recently. Ore from dump being shipped to Clark mill at Stevens Camp and to Rare Metals Co.'s plant at Rollinsville.

### Clear Creek County

TEK (Idaho Springs)—Main tunnel opened 3.5 ft. vein ore assaying 3 oz. gold and 7 oz. silver a ton.

### Lake County

FIDELITY GOLD (Leadville)—Has opened 4-ft. vein in lower tunnel; ore reported high gold with considerable silver and copper. Vein cut by 1,200-ft. tunnel after $75,000 expenditure. Strike locally regarded as of considerable importance.

### San Juan County

BEN BUTLER (Silverton)—Regular shipments of ore being made to Durango smelting plant.

DORA (Silverton)—Property being developed under management of John Hughes. Mill overhauled and operating.

CONTENTION (Silverton)—Tailings from old North Star mill in Little Giant Basin shipped over Contention tram to milling plant and treated by flotation. Excellent recovery and high-grade product made.

### San Miguel County

TELLURIDE SHIPMENTS during September: Tomboy 56 cars; Smuggler-Union 35; Black Bear, 20; Liberty Bell, 12; Columbia one car; total 124 cars.

HIGHLAND MARY (Ophir)—Vein of payable ore opened. J. D. McAlpine, manager.

IMES (Sawpit)—Shaft sunk 75 ft. opened small vein ore containing copper, lead, and zinc.

TOMBOY (Telluride)—In September mill ran 29 days; crushed 13,000 tons; bullion, $29,700; concentrates, $64,000; total yield, $93,700; expenses, 65,600; profit, $28,100.

### Summit County

GIBSON HILL MINING AND MILLING (Breckenridge)—This company, recently organized and composed of Pueblo men, has acquired New York and Ell Lambert groups on Gibson Hill, and Morning Sun group in Barton Gulch, about 20 claims in all. Crew already driving tunnel in Barton Gulch and tunnel to be started at once on New York group. Development on large scale will be prosecuted.

### Teller County

CRESSON CONSOLIDATED GOLD (Cripple Creek)—Sept. 1 reports $1,127,754 cash in bank, together with 95 cars ore in transit valued at $90,000 net. August shipments yielded profit $110,016. Engineer Louis Noble reported $4,162,157 developed ore Sept. 1, an increase of nearly $32,000 over Aug. 1 report after month's extraction.

## ILLINOIS

### Madison County

NEW STAUNTON COAL (Livingston)—New hoisting record made under normal working conditions recently at Livingston shaft, when 5,287 tons coal, filling 116 railway cars, hoisted in 8 hr. Shaft 287 ft. deep; total number trips, 1,800; average time per trip, 16 seconds.

## MICHIGAN

### Copper

WYANDOTTE (Houghton)—Stoping on 9th and drifting on 10th level. Another mill test will be made soon.

ISLE ROYALE (Houghton)—September production 1,130,000 lb. from over 75,000 tons rock averaging 14.2 lb. per ton.

CALUMET & HECLA (Calumet)—Will shortly begin addition to Lake Linden leaching plant to hold two 50-ft. diameter tanks, increasing plant capacity by about one-third. Flotation process experiments reported successful. September production of various subsidiaries: Ahmeek, 2,309,955 lb.; Allouez, 896,184; C. & H., 6,257,477; Centennial, 100,800; Isle Royale, 1,010,723; La Salle, 119,269; Osceola, 1,700,522; Superior, 220,582; Tamarack, 512,666; White Pine, 385,577 lb.; total for month, 13,573,725 lb.; total for nine months, 120,055,000 lb.

## MINNESOTA

### Cuyuna Range

HILL CREST (Ironton)—Initial shipments made recently from pit. Company leased 600-ft. strip adjoining from Cuyuna Realty Co., which tract will be hydraulicked.

CUYUNA REALTY CO. (Ironton)—Tract of 160 acres adjoining Pennington and Hill Crest pits will be operated soon. Portion adjoining Hill Crest leased to that company and will be stripped. Remaining portion will be operated as underground mine.

CUYUNA-MILLE LACS (Ironton)—Over 85,000 tons manganiferous iron ore shipped in 1916, all to American Manganese Manufacturing Co. at Durbar, Penn. Planned to sink another shaft soon as suitable location determined.

### Messabi Range

TENER (Chisholm)—"C" shaft being concreted.

MINORCA (Virginia)—Exploration work has defined a mine. Machinery will be purchased and installed. Property worked at one time but ore played out.

WEBB (Hibbing)—Considering feasibility of operating washing plant throughout winter—innovation on Mesabi Range. Washing process reported to raise iron content from 10 to 12% in ore.

SHENANGO (Chisholm)—Drilling explorations in bottom of pit greatly increased available tonnage. Preparations being made to conduct operations by milling method. Approximately 7,000 tons shipped daily.

STATE OWNED IRON MINES—More than 3,000,000 tons iron ore shipped from 15 state owned properties thus far, making 1916 banner shipping season. Leading shippers are Leonidas, 46,000 tons; Woodbridge, 42,000; Pool, 16,000; Hanna, 11,000; Waconta, 7,000; Grant, 15,000; and Mesaba Mountain, 12,500 tons.

## MISSOURI

### Joplin District

BROOM CORN (Commerce, Okla.)—Sinking new shaft on account of heavy flow water and increased output.

LULU V (Spring City)—Will start up mill again soon after six months' shutdown account heavy flow water.

PREMIUM (Galena, Kan.)—Wilcox & Watson, of Joplin, behind company which has contracted for new mill on Lone Elm lease at Galena.

NORFOLK (Joplin)—Planning 400-ton mill in West Joplin sheet ground field. Boiler of 250-hp. capacity now being installed for shaft sinking. Lease thoroughly drilled.

KING JACK and MIZPAH (Commerce, Okla.)—Names changed by Commerce Mining and Royalty Co., which owns them, to Concentration No. 1 and No. 2. Both operating full force after several months curtailed operations.

CAMPBELL (Spring City)—Mine worked for five or six months with large profits by small company taken over by Raymond & Allendorf, of Oronogo Circle Co., who are erecting bin and connecting with tram to Aladdin mill. Operations in well roofed soft ground at 150 ft.

## MONTANA

### Beaverhead County . .

BOSTON & MONTANA DEVELOPMENT (Wise River)—Arrangements made for first ore shipment from company's Elkhorn mine—25 tons from new shaft. Planned to construct 100-ton concentrator; machinery and material ordered. Mill expected ready for operation by spring. Considerable development work going on both at Elkhorn and Spain mine in French gulch. From latter about 75 tons ore being shipped per week to Washoe smeltery.

### Deerlodge County

GOLD LEAF MINING (Anaconda)—Company incorporated to exploit properties in Granite and Ravalli Counties in what is known as the Frog Pond Basin. Capital stock, $200,000; par value, $1 per share.

### Fergus County

E. SUTTER AND ASSOCIATES, of Lewistown, have shipped three cars of high-grade copper ore that netted approximately $1,000 per car. Also have low-grade deposit.

UNITED STATES GYPSUM (Heath)—Making preparations to erect plaster mill. Company has 300 acres under lease and estimates available gypsum at 7,000,000 tons.

BARNES KING (Kendall)—September report announces option on Woodrow Wilson claims in Rimini district relinquished since all shipping ore in sight exhausted and values decreased from $34.62 to $16.63 per ton. Conditions at company's Piegan-Gloster and Shannon mines near Marysville satisfactory. Gloster mill treated 4,036 tons of ore producing $45,000 bullion. Under contract for purchase of Shannon, about $20,000 will be paid to owners. At North Mocasin in Fergus County, tonnage treated 2,713, bullion valued $15,000, an average of about $6 per ton.

### Lewis and Clark County

NEW YORK & MONTANA TESTING (Helena)—Reported that company headed by C. E. Fryberger will build $30,000 custom mill for treating low-grade ores of Helena district.

MARYSVILLE GOLD (Marysville)—Development work on various options has opened number promising deposits. Crosscut and drift on Mount Pleasant cut good milling ore up to $40 per ton. Another vein cut 100 ft. north of Mount Pleasant by another crosscut, assayed high in free gold. Shaft on Honey Comb furnished several thousand dollars worth shipping ore assaying up to $50 gold.

### Lincoln County

SNOWSTORM (Troy)—Mill of 300-ton daily capacity removed from Larson, Idaho, will probably be in operation about Nov. 1. Reported 400,000 tons of ore developed averaging 7% lead, 8% zinc and 3 oz. silver per ton. Tests indicate 85 to 90% recovery of lead and silver and 40% zinc. Ore is treated by flotation process.

### Mineral County

TARBOX (Saltese)—Compressor plant and power drills now in operation, permitting better progress. Shaft now down to 550 ft., will be extended to 600 level. Management expects shipping ore regularly by end of year. Building of concentrator and flotation plant is planned for coming spring to treat second-class ores.

### Powell County

CUTRIGHT (Elliston)—Regular shipments of copper ore, assaying 5% copper being made from mine to Pittsmont smeltery at Butte. Mine in Snowshoe gulch, 15 mi. from Elliston. Owners plan increase mining equipment in near future. Adjoining properties being rapidly developed.

### Silver Bow County

TIMBER BUTTE MILLING (Butte)—Zinc concentrator of 700-ton daily capacity to be enlarged to 1,000 tons. A 1,500-ton annex will treat copper tailings of old Butte Reduction Works.

## NEVADA

### Esmeralda County

JUMBO JUNIOR (Goldfield)—Property being developed from Jumbo Extension workings. Work on 880-ft. and 1,750-ft. levels exposed large silicified zone yielding encouraging assays.

REORGANIZED KEWANAS (Goldfield)—Raise started near face of north drift, out about 700 ft. from working winze. Reported recent assays vary from $10 to $50 over width of 12 to 30 in.

ATLANTA MINES (Goldfield)—Footwall crosscut passed through 90-ft. vein matter before encountering shale. Vein estimated 60 ft. thick. South drift started near center. Occasional good assays obtained.

### Humboldt County

RAGGED TOP (Lovelock)—Humboldt County Tungsten Mines and Mills Co. incorporated as operating company of the Ragged Top mines and the mill at Toulon. New road from mines to mill, about 10 mi., completed; will be operated as toll road.

LOVELOCK QUICKSILVER (Lovelock)—Five-day run of the recently completed furnace resulted in ten flasks of "quick," which were shipped to San Francisco. Furnace has capacity of five tons per day. Reported company has about 400 tons on dumps ready for treatment; seven men are employed.

### Lincoln County

PRINCE CONSOLIDATED (Pioche)—Shipments of crude ore to smeltery continue at rate of about 3,400 tons per week. Mill at Bullionville running one shift treating about 100 tons per day. Additional equipment ordered will bring capacity to 250 tons per day.

### Lyon County

NEVADA DOUGLAS (Ludwig)—Installing additional leaching tanks for oxidized ore to handle 500 tons per day. Archie J. Orem, superintendent.

### Nye County

TONOPAH ORE PRODUCTION for week ended Oct. 7 was 8,602 tons valued at $170,776 compared with 9,398 tons for week previous. Producers were: Tonopah Belmont, 2,945 tons; Tonopah Extension, 2,380; Jim Butler, 1,100; Tonopah Mining, 900; West End, 695; Rescue-Eula, 219; Halifax, 158; North Star 66; miscellaneous leases, 139 tons.

MONARCH PITTSBURG (Tonopah)—Drifting and raising on large contact vein recently encountered on 1,000-ft. level.

PIONEER CONSOLIDATED (Pioneer)—In addition to company mining and milling operations, four lessees are working.

TONOPAH (Tonopah)—Crusher plant of Desert Power and Milling Co., subsidiary of the Tonopah

company, destroyed by fire, cause unknown. Loss not large as main mill buildings not affected.

GIPSY QUEEN (Tonopah)—Pumps pulled resulting from unexpected flow. Unwatering shaft will be resumed soon as arrangements made for additional pumping capacity.

UNION AMALGAMATED (Manhattan)—Compressor being placed at Bath shaft and incline will be sunk additional 120 ft. Vein in bottom of drift, 500-ft. level, reported to average $80 per ton.

BUCKEYE BELMONT (Tonopah)—Development largely confined to 1,200-ft. level where conditions described as favorable. Has taken over Chipps Creek Consolidated and controlling interest in Empire Plumas gravel properties in Plumas County, Calif.

RESCUE-EULA (Tonopah)—On 950-ft. level, intermediate levels from the winze and No. 5 raise are both in ore of good grade. From bottom of winze a crosscut is being run toward Maggie May claim.

TONOPAH MINING (Tonopah)—Acquired working control Louisiana and Brownie mines of Louisiana Consolidated Co. in Esmeralda County, about 50 mi. west Tonopah. Reported oreshoot on 120 level developed 365 ft. long, 4 to 6 ft. wide assaying $12 to $15 per ton, mostly gold. Milling tests indicate recovery 92%. Mill of 250 tons daily capacity proposed.

## NEW MEXICO

### Grant County

OCTO MINING (Lordsburg)—Filed articles of incorporation; William Davis manager; contract for 500-ft. shaft let Wright Brothers, Bisbee, Ariz.

### Sierra County

LOOKOUT (Kingston)—Miller & Davidson, of Lake Valley, sacking ore assaying 2,250 oz. silver and 41 oz. gold to ton.

## NEW JERSEY

AT BAYONNE after week of rioting resulting in several deaths and many wounded, situation quiet. Strikers' meeting held Oct. 18 to consider question of return to work—three Federal mediators expected to attend. Notice served on Bayonne mayor that city would be expected to pay damages resulting from strike violence. Statement authorized by Standard Oil Co. says strike started with three unskilled laborers paid $3.20 for eight hours—rest of strikers forced out by intimidation. Since Aug. 1, 1915, wages increased 23%, which, together with effect of changing to 8-hr. day, increased costs over 46%.

## SOUTH DAKOTA

### Lawrence County

ORO HONDO (Deadwood)—Shaft 2,000 ft. deep will be continued 1,500 ft. farther. Diamond drilling has been in progress on bottom level for several months.

CUSTER PEAK (Nahant)—Shaft 250 ft. deep will be continued to zone of secondary enrichment. This is probably biggest copper prospect in Lawrence County.

ELK MOUNTAIN (Lead)—Close corporation headed by L. P. Dove, formerly instructor in chemistry and assaying in Lead public schools. Running Deadwood-Standard mill on ore from adjacent Slavonian group with satisfactory results.

TROJAN (Trojan) — Facilities for receipt and sampling of custom ore being installed at cost of $12,000. Raise excavated from Portland mine to surface railway tracks. Track scales will be put in. Crushed ore will drop to underground bins, avoiding freezing in winter, and thence hauled to mill. Company pays for ore upon delivery and agreement as to value. Mill capacity 350 tons daily, with improved slime treatment. Tube mill will be installed at once to take product of chileans. Portal of Portland tunnel being concreted 150 ft.

HOMESTAKE (Lead)—Will erect new hospital at cost of $50,000. Building and foundations for reception of three new tube mills in regrinding plant completed and awaiting arrival of machinery; enlargement will enable all of sands originating in Lead mills to be reground before entering cyanide treatment circuit. New hoisting plant at B. & M. shaft not put in commission owing to nonarrival of skip parts. New boiler and electric plants operating. Five-stamp tungsten mill handling 20 to 25 tons daily. Tailings enter cyanide circuit where gold content is saved. Reported that precious metal pays all costs of handling ore—tungsten concentrates clean profit. Ore averages around 1% $WO_3$.

## TENNESSEE

TENNESSEE COPPER (Copperhill)—Reorganization to be effected Nov. 8 upon approval of two-thirds of stockholders; new corporation to be formed under name of Tennessee Copper and Chemical Co., capitalized at 400,000 shares, of which 200,000 are offered share for share for old stock; remaining 200,000 shares new stock underwritten by Adolph Lewisohn & Son and by J. S. Bache & Co., of New York, at $14 net per share and offered pro rata to old shareholders at $16. Plan provides $2,800,000 net, of which $2,750,000 will be loaned Tennessee Copper Co. to settle $1,140,000 indebtedness to Russian government growing out of destruction of acid plant by fire, and provides little working capital over other indebtedness.

## UTAH

### Beaver County

INDIAN QUEEN (Frisco)—First car ore shipped since resumption of work. Ore came from raise above tunnel level, and from dump, being worked over. K. S. Jordan, manager.

BEAVER COPPER (Milford)—Ore opened in four places on 100-ft. level, showing from 1 to 12 ft. in thickness. Drills ordered and stoping to be started soon. Lewis Merriman, superintendent.

MOSCOW (Milford)—September shipments totaled 10 cars compared with 9 in August. New Cullen shaft down to 1,100, station cut, drifting started for oreshoots at greater depth. Recently copper and zinc ore added to output, formerly largely lead-silver.

### Juab County

PLUTUS (Eureka)—Control taken over by Chief. Drift from 1,000 level of Chief started for this ground.

BECK TUNNEL (Eureka)—Lease given recently on block adjoining Yankee, in north end of property.

EUREKA-LILY (Eureka)—Large cave opened in winze from 500 level shows some mineralization. Plan to sink main 500-ft. shaft to greater depth.

EUREKA LILY (Eureka)—Sinking shaft—now down to 650. Strong fissure being followed shows mineralization. Three shifts worked, and 5 ft. a day made. Property adjoins Tintic Standard.

TINTIC STANDARD (Eureka)—Five hundred tons ore shipped September from new strike brought $17,000, or about $34 per ton. Furnishes funds enough to sink new shaft to level producing ore.

SIOUX CONSOLIDATED (Eureka)—Retimbering parts of shaft being done by contractors, who will sink from 600- to 1,000-ft. level. Now sinking winze from 600 on fissure mineralized with copper.

GODIVA (Eureka)—Lessees drifting on 700 to reach body of ore mined from winze on level above. Six blocks ground worked by lessees. Some Godiva ore carries $3 to $4 gold besides other metals.

CHIEF CONSOLIDATED (Eureka)—Homansville shaft down 575 ft. Station being cut and drifting started. Water encountered but sinking to be resumed soon as pumps—ordered—have been installed.

RIDGE & VALLEY (Eureka)—Orebody followed for 300 ft. on 1,600, cut on 1,700. Small pump will be installed to handle 40 gal. per minute flow, recently developed. Work being carried on through Gemini.

EUREKA MINES (Eureka)—Drifts being driven into this ground from lower levels of Gemini. Drift on 1,300 struck ore of stoping dimensions, running well in silver and lead. Company recently incorporated; new producer for Tintic district promised.

TINTIC MILLING (Silver City)—Good progress made in installing eight new roasters and other equipment, increasing capacity to 300 tons a day. Six roasters are in place, and other two will be ready by end of month. Another car precipitates ready for shipment. Arrangements being made so that shut down of only two or three days will be necessary for changing over to new equipment.

GEMINI (Eureka)—Another car high-grade silver ore shipped from Carlson-Backman lease, expected to run about 500 oz. silver, in addition to lead, copper and gold. Previous car brought about $14,000, of which 50% was royalty. High-grade silver ore occurs in pipes or shoots surrounded by bodies of lower grade, but shipping material. High-grade being followed by two raises from 1,400.

### Salt Lake County

COTTONWOOD KING (Salt Lake)—Lessee working in western end of Giles group opened ore. Cottonwood King workings have showing in tunnel.

ALTA TUNNEL AND TRANSPORTATION (Alta)—Tunnel at head of Silver Fork—in 2,000 ft.—approaching vein. Clements claims lying beyond face of tunnel recently acquired. Two shifts working.

VICTOR (Mammoth)—Reported that property will be opened at depth through Iron Blossom. Opened to depth of 800 ft. Much undeveloped territory. Lessees working on 250 level, with small hoist; main hoist destroyed by fire last year.

OHIO COPPER (Bingham Cañon)—Referee in bankruptcy enjoined from confirming sale of property to bondholders' committee. Stay granted at request of North American Liquidation Co. to allow plans prepared giving stockholders chance to rehabilitate company.

MICHIGAN-UTAH CONSOLIDATED (Alta)—Reorganization of Michigan-Utah. Contract made for sale of 400,000 shares at 25c. a share. Ore sold by lessees since Jan. 1 brought $78,200, affording company net profit of $11,896. Lessees shipping two cars daily from above Grizzly and Cleaves tunnels. Company crosscutting from Copper Prince tunnel, to cut Lavinia and City Rocks veins known to continue to depth.

## WASHINGTON

NORMAN MINES (Northport)—Deep development of Great Western and Last Chance mines disappointing and lease on properties will be relinquished.

## WISCONSIN

MAUDE (Benton)—Lead orebody encountered at 115-ft. level on James Calvert lease.

DOMESTIC (Benton)—In sinking new shaft on McCabe-Buchan lease, a 6-ft. width of rich jack ground was penetrated.

## CANADA

### British Columbia

PATHFINDER (Kettle River)—This North Fork property will soon ship 30 tons daily to Granby smeltery.

BIG COPPER (Greenwood)—Three teams hauling ore to Deadwood for shipment by rail to British Columbia Copper Co.'s smeltery. Mining operations in charge of James Poggi.

CONSOLIDATED MINING AND SMELTING CO. (Trail)—Over 175 tons of fabricated steel required for new addition to leaching building of electrolytic zinc plant. New building 165x200 ft.; erection well under way. Steel all comes from Pittsburgh, Penn., but fabricated in Vancouver, B. C. Shipments of ore to Trail smeltery for year now total over 375,000 tons.

BRITISH COLUMBIA COPPER (Greenwood)—Installing pumping plant to elevate water from Similkameen River to distributing point 1,700 ft. above river, through pipe line 6,000 ft. in length. Pumping equipment consists of Gould triplex pumps; pipe line composed of 4-in. high pressure hydraulic pipe in lower section and steel pipe of 6 in. diameter at discharge. Water will supply mine, camp and 50-ton experimental concentrating plant building to test Copper Mountain ores.

### Ontario

ST. ANTHONY (Sturgeon Lake)—Purchased by the Lewisohns and D. M. Steindler, of New York.

DOME (Porcupine)—Open cut ore, generally assaying about $4, has recently assayed over $6.

PLATT (Porcupine)—Under option to Coniagas. Extension Schumacher vein system cut with diamond drill.

McKINLEY-DARRAGH (Cobalt)—Good ore, of varying values, being developed on vein recently struck in winze at 300-ft. level.

BOSTON CREEK GOLD (Boston Creek)—New company formed to develop Kenzie. High-grade gold ore found on 100- and 200-ft. levels.

NIPISSING (Cobalt)—In September mined ore of estimated value $236,873, and shipped bullion and customs ore of estimated value $413,753. New discovery made on Cobalt Lake fault.

MURRAY-MOWGRIDGE (Bourke's Station)—Two shafts sunk 2,000 ft. apart on same vein, which in No. 1 shaft is 17 ft. wide and in No. 2 3 ft. wide. Sampling done in both shafts is reported to show average of $10.05 per ton.

TRETHEWEY (Cobalt)—At recent shareholders' meeting deal involving sale of property for $125,000 was definitely abandoned, and property will be operated by company. September profit was $10,000. Cash and silver on hand totals $101,000.

MAIDENS MACDONALD (Porcupine) — This property, worked under option by La Rose Consolidated has two shafts down 115 and 112 ft. respectively on high-grade vein 9 to 12 ft. in width. Machinery from old University mine at Cobalt will be installed.

WEST DOME (Porcupine)—Material and labor shortage responsible for cancellation of plant order. Opening up and blocking out ore will be continued. Ore averaging about $7 per ton being brought up from 300-ft. level on veins Nos. 1 and 2.

TEMISKAMING (Cobalt)—Report for quarter ended Sept. 30: Total bullion in storage and transit, 707,287 oz.; cash on hand, $25,074. Development totaled 1,053 ft.; stoping, 3,288 cu.yd. Main shaft, 1,325 ft. down, must continue 300 ft. to reach lower contact. Largest orebody on 500 level where vein is 8 to 14 in. wide and assays very rich.

BEAVER (Cobalt)—Quarterly statement for period ending Aug. 31 shows bullion on hand, ore at smelters and ore at mine ready for shipment to value of $313,905; cash on hand, $43,030; total, $356,935, as against $686,965 for period ended May 31. Company has been spending considerable money at Kirkland Lake on McKane property, which shows 35 ft. of $9 ore on 300-ft. level.

## AFRICA

### Rhodesia

GOLD PRODUCTION IN AUGUST reported at 80,909 oz., increase of 3,909 oz. over September, but a decrease of 1,636 oz. from August, 1915. For eight months ended Aug. 31 total was 601,954 oz. in 1915, and 619,964 oz.—or $12,814,656—in 1916; an increase of 18,010 oz. this year. Other production in August was 18,326 oz. silver, 351 tons copper, 1 ton wolframite, 675 tons asbestos, 13,551 tons chrome ore, 48,816 tons coal. The diamonds reported were 128 carats.

# The Market Report

## Metal Markets

**NEW YORK—Oct. 18**

The principal markets were dull during the last week at substantially unchanged prices. There was the most active demand in lead, but in the main this was on account of contracts settled at average price.

## Copper, Tin, Lead and Zinc

**Copper**—Business was relatively light—the aggregate being much less than in the previous week. That which was done was mainly for delivery during the first quarter of 1917 and was booked at 27½c., r.t., equivalent to 27¼c., cash, New York. There was a small amount of business running forward to the middle of 1917 done at at lower prices and also a small amount for prompt delivery and November-December, quotations ranging from 29c., r.t., for prompt down to 28@28¼c. for December. Sales of first-quarter copper during the last week included some for export.

**Copper Sheets**, base price, nominally 37½c. for hot rolled and 38½c. for cold rolled for delivery at mill convenience. Earlier deliveries mainly on toll basis. Wire 32@32½c., nominal.

**Visible Stocks of Copper in Europe** on Oct. 15: Great Britain, 3,880; France, 1,740; afloat from Chile, 1,250; afloat from Australia, 3,800; total, 10,670 gross tons, or 23,900,800 lb. This is an increase of 299 tons over the Sept. 30 report.

**Exports from Baltimore** for the week included 2,913,276 lb. copper bars and ingots to Archangel, Russia; 181,825 lb. brass tubes and rods to Liverpool; 377 tons sheet brass to Genoa, Italy.

**Tin**—Business was rather slow, especially in spot. Futures were quoted at 40⅞c. on Oct. 13, declined to 40¾c. on the 16th, and advanced to 40⅞c. on the 18th.

**Lead**—There was an active demand from consumers who take in their supplies on average contracts, but outside buying was light. Several of the large producers are completely sold out both for October and November. On the other hand, consumers appear to have covered their expected requirements. There was a strong demand for Missouri brands consequently the St. Louis market stiffened further.

**Spelter**—This market was very dull. Good inquiry on Oct. 17 was reported, especially from refiners who buy common spelter and convert it into high grade, but no considerable volume of business appears to have resulted. For the moment the chief business is in high grade, intermediate and brass special. Galvanizers are not buyers to any considerable extent, and irrespective of the terms for spelter, buying from them is not expected in view of the present situation in the steel business. Although the market was dull, large producers displayed no nervousness and offerings at concessions by small producers were promptly cleaned up. However, the market showed a slightly weaker tone. Business in brass special was reported done at 10¼c. High grade was quoted at 15@16 cents.

The quotation for zinc on Oct. 11 in our table last week was given at 9.50@9.92½c. by a misprint. It should have been 9.50@9.62½c., St. Louis on that day.

**Zinc Sheets** are in good demand and base price remains $15 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

## Other Metals

**NEW YORK—Oct. 18**

**Aluminum**—Spot supplies still scarce and contract deliveries slow on good demand. Quotations 65@67c. per lb. for No. 1 ingots.

**Antimony**—The improvement continued further, considerable transactions being consummated. The reduction in stocks, which no longer are heavy, contributes to the strength of the present position. Some producers have no spot metal at all. We quote 13@14c. for early deliveries.

**Quicksilver**—Considerable business was done at $80 per flask. San Francisco reports, by telegraph, $77.50, market steady.

**Nickel**—Market steady and unchanged at 45@50c. per lb. for ordinary forms; with 5c. premium for electrolytic metal.

**Minor Metals**—Current quotations for **Bismuth** are $3.15@3.30 per lb., New York—**Cadmium** is quoted at $1.30@1.50 per lb.—**Cerium**, electrolytic, is sold at $8@9 per lb.—**Cobalt Metal** is quoted at $1.35 per lb.—**Magnesium** is steady, with sales at $3.50@3.75 per lb. for 99% pure—**Selenium** is from $3 up to $5 per lb., according to size of order.

## Gold, Silver and Platinum

**NEW YORK—Oct. 18**

**Gold**—After a suspension of about a month gold receipts from Ottawa were resumed by the arrival at New York on Oct. 17 of $5,500,000. Most of these receipts are understood to be South African gold.

**Silver**—The market has remained steady for the past week without special feature. Supplies being eual to demand.

Mexican dollars at New York were quoted Oct. 13 at 52⅛@55⅛c.; Oct. 14 at 52¼@55¼c.; Oct. 16 at 52½@55⅛c.; Oct. 17 at 52¼@55¼c.; Oct. 18 at 52⅜@55⅜c. Supplies are still rather scarce.

**Platinum**—Business is reported fair to good, at $90 per oz., market strong, but the supply is said to be sufficient.

## Zinc and Lead Ore Markets

**Joplin, Mo.—Oct. 14**—Price quotations per 2,000 lb.: Blende, high, $71.40; 60% zinc, premium ore, $70; medium grades, $69@65; low, $62. Calamine, per ton 40% zinc, $45@35. Average selling price, all grades of zinc, $58.23 per ton.

Lead, high price, $87.60; base price, $87@80. Average selling price, all grades of lead, $75.79 per ton.

Shipments of the week, blende 8,534 tons, calamine, 407 tons; lead, 1,110 tons. Value, all ores the week, $604,720; the year to date, $29,422,530.

Lead price advances have been a notable feature of the past month, going this week to an $87 base. Zinc blende advanced on premium ore to $70, while in three weeks medium grades have climbed to $69 from $50 base.

There was no cessation of the active demand during the week, which closes as strong as have the past four weeks. In five weeks 43,600 tons of zinc have been shipped out of this district, some 13,000 tons more than produced, proving that the reserve stock is becoming limited.

**Platteville, Wis., Oct. 14**—Quotations of the district are according to the following figures: Base price per 2,000-lb. ton for material assaying 60% zinc, is $60 for premium ore down to $55 for medium grade. For material assaying 80% lead, the base price per 2,000-lb. ton is $76. Shipments for the week were 4,035 tons of zinc ore, 35 tons of lead ore, and 701 tons of sulphur ore. For the year to date the figures are 100,625 tons of zinc ore, 3,463 tons of lead ore, and 24,424 tons of sulphur ore. Shipped during week to separating plants, 4,443 tons of zinc ore.

This is the largest week's shipment ever reported from this district and decreases the surplus stock in bins. The production is fully maintained by incoming new properties taking the place of the low-grade producers, which were forced to close down on account of lower prices.

## Other Ores

**Antimony Ore**—Continues in demand, but little is available at present, the lower prices lately ruling having automatically restricted production.

**Molybdenum Ore**—It is reported that several orders for ferro-molybdenum could not be placed in this market, the present supply of ore being too uncertain and too small. The quotation remains unchanged at $1.50@1.75 per lb. of $MoS_2$.

**Tungsten Ore**—Business done, as reported by all sellers, was at $17 per unit, which we quote as the market.

Charles Hardy reports as follows, under date of Oct. 17: "Since my last report the tungsten market has continued exceedingly active and again several hundred tons have changed hands. Europe has been the main buyer, taking, to my absolute knowledge, about 150 tons. Quite an equal amount has been absorbed by our home market, and $17 has again been paid for high-class material. A considerable amount of ore, showing objectionable impurities, has changed hands at lower figures, which are sometimes quoted in the market as business having been done at $15, or even below. A further contract for forward delivery, as a matter of fact, for delivery up to January, 1918, has been closed at $17. This is the second contract closed within the last fortnight, and it appears as if the consumers have come to look upon $17 as a fair price under present conditions. The market for ferrotungsten remains good, with considerable inquiries from abroad and prices have advanced to about $2.70 for the highest grade."

## Iron Trade Review

**NEW YORK—Oct. 18**

Little change in conditions in the iron and steel markets. Export demand continues large, though shipments are temporarily held up by fear of submarine activities.

The pig-iron market is very active, with large sales both domestic and for export. Alabama furnaces are very busy; more basic iron is being made in the South than ever before, and foundry demand is also good.

### SILVER AND STERLING EXCHANGE

| Oct. | Sterling Exchange | Silver: New York, Cents | Silver: London, Pence | Oct. | Sterling, Exchange | Silver: New York, Cents | Silver: London, Pence |
|---|---|---|---|---|---|---|---|
| 12 | ..... | ... | 32 5/16 | 16 | 4.7563 | 68¼ | 32 5/16 |
| 13 | 4.7569 | 67¾ | 32 5/16 | 17 | 4.7563 | 67¾ | 32 5/16 |
| 14 | 4.7563 | 68 | 32¼ | 18 | 4.7563 | 67¾ | 32 5/16 |

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

### DAILY PRICES OF METALS IN NEW YORK

| Oct. | Copper: Electrolytic | Tin: Spot. | Lead: N. Y. | Lead: St. L. | Zinc: St. L. |
|---|---|---|---|---|---|
| 12 | ..... | ... | .... | ..... | ..... |
| 13 | 27 @27¼ | 41¼ | 7.00 | 6.87½ @6.92½ | 9.50 @9.62½ |
| 14 | 27 @27¼ | 41¼ | 7.00 | 6.87½ @6.92½ | 9.50 @9.62½ |
| 16 | 27 @27¼ | 41¼ | 7.00 | 6.87½ @6.92½ | 9.50 @9.62½ |
| 17 | 27 @27¼ | 40¾ | 7.00 | 6.90 @6.92½ | 9.25 @9.37½ |
| 18 | 27 @27¼ | 40¾ | 7.00 | 6.90 @6.92½ | 9.12½ @9.37½ |

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only St. Louis price is given, St. Louis being basing market. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

### LONDON

| Oct. | Copper: Standard Spot | Copper: Standard 3 Mos. | Copper: Electrolytic | Tin: Spot | Tin: 3 Mos. | Lead: Spot | Zinc: Spot |
|---|---|---|---|---|---|---|---|
| 12 | 123 | 118½ | 142½ | 180⅞ | 181⅜ | 30½ | 56 |
| 13 | 123 | 118½ | 143 | 180½ | 181¼ | 30½ | 56 |
| 14 | .... | .... | .... | .... | .... | .... | .... |
| 16 | 123 | 118½ | 143 | 179½ | 180 | 30½ | 54½ |
| 17 | 123½ | 119 | 143 | 178½ | 178½ | 30½ | 53 |
| 18 | 123½ | 120 | 143 | 178½ | 179¼ | 30½ | 53 |

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. Copper quotations for electrolytic are subject to 3% discount. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21⅜ cents.

### PITTSBURGH—Oct. 17

The decrease of 137,773 tons in the Steel Corporation's unfilled obligations during September represents the fact that some of its subsidiary companies were almost entirely out of the market, having already sold ahead as far as they desired. Much more tonnage could have been booked had the obligations been desired.

The whole steel situation has continued to gain in strength, with no weakness appearing at any point. It is the common view that the steel mills will be under high pressure throughout 1918. Steel production is now at a heavier rate, weather conditions being exceptionally favorable.

The cruder materials are advancing, pig iron stiffening almost daily, while heavy melting steel is up to $19, an advance of $1.50 in a fortnight. Coke has advanced sharply and coal is bringing record high prices, these developments tending to strengthen further the steel market.

**Pig Iron**—All sellers are reserved and are looking for higher prices. We quote: Bessemer, $24; basic, $20; foundry, $20@20.50; malleable, $20; forge, $19.50, all f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

**Steel**—There are still no regular offerings of billets or sheet bars at any price. The market is regarded as $45 to $50, as formerly.

## Ferroalloys

**Ferrosilicon**—For 50% alloy $86@89 per ton at furnace is quoted. Advance to $100 expected. For bessemer silicon from $30 for 9% up to $41 for 10% at furnace.

**Spiegeleisen**—Ordinary 20% is $35@45 at furnace; high grade, 25@30% is $55@65 according to size and terms of order.

**Ferromanganese**—It is reported that one or two of the steel interests, usually making ferromanganese only for their own use, have sold for next year's delivery at $162. Price of the merchant sellers continues at $165, with imported at $165, with occasional shading.

## Iron Ore

Of the Lake Superior iron ore shipments in September 7,871,851 tons went to Lake Erie ports.

Shipments of iron ore from Lake Erie docks in September were 4,937,462 tons. The tonnage on docks, Oct. 1, was 7,230,024 tons, being 755 962 tons less than last year.

## Coke

**Connellsville**—Spot furnace coke has been advancing almost daily, consumers being short in receipts on contract and bidding higher and higher prices. Today a week ago a sale at $4 40 represented a new high price, but advances have continued, and last evening and this morning there have been perhaps half a dozen sales at $5.25. Absolutely authentic information has been obtained that two first-half contracts have just been made at $3.75, aggregating about 35,000 tons a month. The regular asking price is now $4. About three-fourths of the coke to be bought for first-half is now under cover, at prices ranging from $2.75 to $3.75. Foundry coke has been advancing in sympathy with furnace. We quote: Spot furnace, $5.25; contract, $3.75; spot foundry, $5@5.50; contract, $3.75, per net ton at ovens. The Pittsburgh coal market has experienced the greatest rise in the past week it has ever experienced in such time. Buyers are readily paying $3.25 for ordinary steam and $3.75 for gas coal, per net ton f.o.b. Pittsburgh district mine, for spot shipment. The car scarcity has grown acute.

**Anthracite Shipments** in September were 5,544,076 gross tons, being 12,279 tons more than in August but 118,081 tons less than in September, 1915 For the nine months ended Sept. 30 the total shipments were 48,556,940 tons in 1915, and 49,930,416 in 1916; increase, 1,373,476 tons, or 2.8% this year.

## Chemicals

### NEW YORK—Oct. 18

**Arsenic**—Demand and supply about even, with prices unchanged at $6@6.25 per 100 lb., New York.

**Copper Sulphate**—Demand good and prices firmer at $12@12.25 per 100 lb., according to size of order.

**Nitrate of Soda**—Sales fair, with prices a little easier at $2.90 per 100 lb. for spot. Imports into United States seven months ended July 31 were 751,234 gross tons, an increase of 314,290 tons over last year.

**Sulphuric Acid**—Demand good, with market a shade easier, under sharp competition. Quotations $1 per 100 lb. for 60-deg.; $1.25@1.50 for 66-deg. acid.

**Sulphate of Ammonia** production in Great Britain is reported by the Inspector of Alkali Works for 1915 as follows: Gas works, 173,675 tons; iron works, 15,142; shale works, 58,826; coke ovens 145,406; producer gas, etc., 33,218; total, 426,267 gross tons, or only 155 tons less than in the preceding year.

## STOCK QUOTATIONS

| N. Y. EXCH.† | Oct. 17 |
|---|---|
| Alaska Gold M. | 12 |
| Alaska Juneau | 7 |
| Am.Sm.&Ref.,com. | 110⅛ |
| Am. Sm. & Ref., pf. | 116⅛ |
| Am. Sm. Sec., pf. A | 95½ |
| Am. Sm. Sec., pf. B. | 88 |
| Am. Zinc | 47⅛ |
| Am. Zinc, pf. | 77½ |
| Anaconda | 93⅛ |
| Batopilas Min. | 1¼ |
| Bethlehem Steel | 546 |
| Bethlehem Steel, pf. | 133 |
| Butte & Superior | 63⅜ |
| Chile Cop. | 21 |
| Chino | 54½ |
| Colo.Fuel & Iron | 54 |
| Crucible Steel | 85⅛ |
| Dome Mines | 24½ |
| Federal M. & S. | 19 |
| Federal M. & S., pf. | 40 |
| Great Nor., ore ctf. | 43 |
| Greene Cananea | 51⅛ |
| Homestake | 133½ |
| Inspiration Con. | 64 |
| International Nickel | 52⅜ |
| Kennecott | 52⅛ |
| Lackawanna Steel | 85⅛ |
| Miami Copper | 38 |
| Nat'l Lead, com. | 68⅛ |
| National Lead, pf. | 115 |
| Nev. Consol. | 22⅛ |
| Ontario Min. | 6⅛ |
| Quicksilver | 2⅛ |
| Quicksilver, pf. | 3⅛ |
| Ray Con. | 25⅛ |
| Republic I.&S.,com. | 75⅛ |
| Republic I. & S. pf. | 112⅛ |
| Sloss-Sheffield | 60⅛ |
| Tennessee Copper | 23⅛ |
| U. S. Steel, com. | 113⅛ |
| U. S. Steel, pf. | 120⅛ |
| Utah Copper | 94⅛ |
| Va. Iron C. & C. | 44 |

| N. Y. CURB† | Oct. 17 |
|---|---|
| Beaver Con. | .40 |
| Buffalo Mines | ‡1 |
| Butte & N. Y. | 1⅛ |
| Butte C. & Z. | 7⅛ |
| Caledonia | .58 |
| Can. Cop. Corpn. | 1⅛ |
| Cashboy | .05 |
| Cerro de Pasco | 38 |
| Con. Ariz. Sm. | 1⅛ |
| Con. Coppermines | 2⅛ |
| Con. Nev.-Utah | .25 |
| Crystal Cop. | 1⅛ |
| First Nat. Cop. | 4⅛ |
| Florence | .72 |
| Goldfield Con. | .61 |
| Goldfield Merger | .07½ |
| Granite | .40 |
| Hecla Min. | 5 |
| Howe Sound | 5⅛ |
| Jerome Verde | 2⅛ |
| Joplin Ore & Spel. | .50 |
| Kerr Lake | 4⅛ |
| Magma | 17⅛ |
| Majestic | .52 |
| McKinley-Dar-Sa. | .60 |
| Mother Lode | .34 |
| Nevada Hills | .20 |
| N. Y. & Hond. | 14⅛ |
| Nipissing Mines | 7⅞ |
| Oro | .03 |
| Ray Hercules | 3⅛ |
| Rochester Mines | .58 |
| St. Joseph Lead | 18⅛ |
| Standard S. L. | 1⅜ |
| Stewart | ⅞ |
| Success | .37 |
| Tonopah | 5⅞ |
| Tonopah Ex. | 4⅛ |
| Tribullion | ⅞ |
| United Zinc | 4⅛ |
| White Knob, pf. | 1⅛ |
| White Oaks | 4⅛ |
| Yukon Gold | 2⅛ |

| SAN FRAN.* | Oct. 17 |
|---|---|
| Alta | .03 |
| Andes | .11 |
| Best & Belcher | .06 |
| Bullion | .01 |
| Caledonia | .28 |
| Challenge Con. | .05 |
| Confidence | .10 |
| Cons. Imperial | ‡.01 |
| Con. Virginia | .11 |
| Gould & Curry | .03 |
| Hale & Norcross | .06 |
| Jacket-Cr. Pt. | .04 |
| Mexican | .13 |
| Occidental | .65 |
| Ophir | .17 |
| Overman | ‡.06 |
| Savage | .10 |
| Seg Belcher | .02 |
| Sierra Nevada | .29 |
| Union Con. | .56 |
| Utah Con. | .01 |
| Belmont | 4.50 |
| Jim Butler | .92 |
| MacNamara | .12 |
| Midway | .22 |
| Mont.-Tonopah | .21 |
| North Star | .15 |
| Rescue Eula | .21 |
| West End Con. | .67 |
| Atlanta | .09 |
| Booth | .10 |
| C.O.D. Con. | .03 |
| Comb. Frac. | .06 |
| D'field B.B. | .05 |
| D'field Daisy | .05 |
| Jumbo Extension | .35 |
| Round Mountain | .38 |
| Sandstorm Kendall | .04 |
| Silver Pick | .18 |
| Central Eureka | .05 |
| Argo | .08 |
| Ariz. Central | .10 |
| Big Jim | 1.25 |
| Lazy Boy | .06 |
| Oatman No. Star | ‡.14 |
| Tom Reed | 2.15 |
| United Eastern | 3.50 |
| United Western | .06 |

| BOSTON EXCH.* | Oct. 17 |
|---|---|
| Adventure | 3½ |
| Ahmeek | 104 |
| Algomah | 1 |
| Allouez | 69 |
| Ariz. Com., ctfs. | 12⅛ |
| Bonanza | .25 |
| Butte-Ballaklava | 2⅛ |
| Calumet & Ariz. | 75 |
| Calumet & Hecla | 570 |
| Centennial | 21 |
| Copper Range | 67½ |
| Daly West | 2⅛ |
| East Butte | 15 |
| Franklin | 8⅛ |
| Granby | 91½ |
| Hancock | 13 |
| Helvetia | .25 |
| Indiana | 3 |
| Island Cr'k, com. | 44 |
| Island Cr'k, pfd. | 90 |
| Isle Royale | 33⅛ |
| Keweenaw | 6 |
| Lake | 13⅛ |
| La Salle | 4 |
| Mason Valley | 4⅛ |
| Mass | 15⅛ |
| Mayflower | 2⅛ |
| Michigan | 4 |
| Mohawk | 93⅛ |
| New Arcadian | 6⅛ |
| New Idria | 14⅛ |
| North Butte | 20⅛ |
| North Lake | 1⅛ |
| Oilbway | 1⅛ |
| Old Colony | 2 |
| Old Dominion | 70 |
| Osceola | 89 |
| Quincy | 89 |
| St. Mary's M. L. | 86⅛ |
| Santa Fe | 2⅛ |
| Shannon | 9⅛ |
| Shattuck-Ariz. | 29 |
| So. Lake | 5⅛ |
| So. Utah | .25 |
| Superior | 15 |
| Superior & Bost. | 4 |
| Tamarack | 43⅛ |
| Trinity | 7 |
| Tuolumne | .70 |
| U. S. Smelting | 72 |
| U. S. Smelt'g, pf. | 51⅛ |
| Utah Apex | 3⅛ |
| Utah Con. | 14⅛ |
| Utah Metal | 7⅛ |
| Victoria | 4⅛ |
| Winona | 5 |
| Wolverine | 46⅛ |
| Wyandot | 1⅛ |

| BOSTON CURB* | Oct. 17 |
|---|---|
| Bingham Mines | 9⅛ |
| Boston Ely | .76 |
| Boston & Mont. | .78 |
| Butte & Lon'n Dev. | .65 |
| Calaveras | 5⅛ |
| Calumet-Corbin | .02⅛ |
| Chief Con. | 2 |
| Cortez | .35 |
| Crown Reserve | .45 |
| Davis-Daly | 2⅛ |
| Eagle & Blue Bell | 1⅛ |
| Houghton Copper | 1⅛ |
| Iron Cap Cop., pf. | 5⅛ |
| Mexican Metals | .30 |
| Mines of America | 2⅛ |
| Mojave Tungsten | 3⅛ |
| Nat. Zinc & Lead | .55 |
| Nevada-Douglas | 1⅛ |
| New Baltic | 2⅛ |
| New Cornelia | 17 |
| Ohio Copper | .18 |
| Oneco | .80 |
| Raven Copper | ‡.07 |
| Rex Cons. | .27 |
| Rilla | .11 |
| United Verde Ext. | 38⅛ |

| SALT LAKE* | Oct. 17 |
|---|---|
| Big Four | .95 |
| Black Jack | .10 |
| Cardiff | 7.40 |
| Colorado Mining | .15 |
| Crown Point | .05⅛ |
| Daly-Judge | 7.95 |
| Emma Cop. | 2.87½ |
| Gold Chain | .20 |
| Grand Central | .68 |
| Iron Blossom | 1.62½ |
| Lower Mammoth | .05 |
| May Day | .13 |
| Opohongo | ‡.01½ |
| Prince Con. | 1.30 |
| Seven Troughs | ‡.03 |
| Silver-King Coal'n | 3.00 |
| Silver King Con. | 3.67½ |
| Sioux Con. | .16 |
| So. Hecla | 2.12½ |
| Uncle Sam | .04 |
| Wilbert | .06 |
| Yankee | .18 |

| TORONTO* | Oct. 17 |
|---|---|
| Adanac | ‡.25 |
| Bailey | .07¼ |
| Chambers Feriand | .17 |
| Coniagas | 4.90 |
| La Rose | .57 |
| Peterson Lake | .20 |
| Right of Way | .05 |
| Seneca Superior | .09 |
| T. & Hudson Bay | 65.00 |
| Temiskaming | .61 |
| Wettlaufer-Lor. | .11 |
| Dome Exten. | .31 |
| Dome Lake | .60 |
| Foley O'Brien | .70 |
| Hollinger | 6.85 |
| Jupiter | .26 |
| McIntyre | 1.43 |
| Newray | .69 |
| Porcu. Crown | .66 |
| Vipond | .36 |
| West Dome | .33 |

## STOCK QUOTATIONS—Continued

| COLO. SPRINGS | Oct. 17 |
|---|---|
| Doctor Jack Pot | .09 |
| Elkton Con. | .13 |
| El Paso | .40 |
| Findlay | .03½ |
| Gold Sovereign | .06 |
| Golden Cycle | 2.29 |
| Granite | .74 |
| Isabella | .22½ |
| Jack Pot | ‡.05 |
| Mary McKinney | .31 |
| Portland | 1.94 |
| Vindicator | 1.90 |

| LONDON | Oct. 4 |
|---|---|
| Alaska Mexican | £0 15s0d |
| Alaska Tre'dwell | 4 0 0 |
| Burma Corp. | 4 7 6 |
| Cam & Motor | 0 10 9 |
| Camp Bird | 0 7 6 |
| El Oro | 0 9 6 |
| Esperanza | 0 11 6 |
| Mexico Mines | 3 17 6 |
| Nechi, pfd. | 0 13 6 |
| Oroville | 0 17 6 |
| Santa Gert'dis | 0 12 0 |
| Tomboy | 1 1 6 |

* Bid prices. † Closing prices. ‡ Last Quotations.

## MONTHLY AVERAGE PRICES OF METALS

| Silver | New York | | | London | | |
|---|---|---|---|---|---|---|
| | 1914 | 1915 | 1916 | 1914 | 1915 | 1916 |
| January | 56.572 | 48.855 | 56.775 | 26.553 | 22.731 | 26.960 |
| February | 57.506 | 48.477 | 56.755 | 26.573 | 22.753 | 26.975 |
| March | 58.067 | 50.241 | 57.935 | 26.788 | 23.708 | 27.597 |
| April | 58.519 | 50.250 | 64.415 | 26.958 | 23.709 | 30.662 |
| May | 58.175 | 49.915 | 74.269 | 26.704 | 23.570 | 35.477 |
| June | 56.471 | 49.034 | 65.024 | 25.948 | 23.267 | 31.060 |
| July | 54.678 | 47.519 | 62.940 | 25.219 | 22.597 | 30.000 |
| August | 54.344 | 47.163 | 66.083 | 25.979 | 22.780 | 31.498 |
| September | 53.290 | 48.680 | 68.515 | 24.260 | 23.591 | 32.584 |
| October | 50.654 | 49.385 | ..... | 23.199 | 23.925 | ..... |
| November | 49.082 | 51.714 | ..... | 22.703 | 25.094 | ..... |
| Dec. | 49.375 | 54.971 | ..... | 22.900 | 26.373 | ..... |
| Year | 54.811 | 49.684 | ..... | 25.314 | 23.675 | ..... |

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

| Copper | New York | | London | | | |
|---|---|---|---|---|---|---|
| | Electrolytic | | Standard | | Electrolytic | |
| | 1915 | 1916 | 1915 | 1916 | 1915 | 1916 |
| Jan. | 13.641 | 24.008 | 60.756 | 88.083 | 65.719 | 116.167 |
| Feb. | 14.394 | 26.440 | 63.494 | 102.667 | * | 133.167 |
| Mar. | 14.787 | 26.310 | 66.152 | 107.714 | * | 136.000 |
| April | 16.811 | 27.895 | 75.096 | 124.319 | * | 137.389 |
| May | 18.506 | 28.625 | 77.600 | 135.457 | * | 152.522 |
| June | 19.477 | 26.601 | 82.574 | 112.432 | 95.333 | 137.455 |
| July | 18.796 | 23.865 | 76.011 | 95.119 | 91.409 | 125.500 |
| Aug. | 16.941 | 26.120 | 68.673 | 110.283 | 82.333 | 126.304 |
| Sept. | 17.502 | 26.855 | 68.915 | 113.905 | 85.250 | 134.071 |
| Oct. | 17.686 | ..... | 72.601 | ..... | 88.000 | ..... |
| Nov. | 18.627 | ..... | 77.744 | ..... | 93.273 | ..... |
| Dec. | 20.133 | ..... | 80.773 | ..... | 100.430 | ..... |
| Year | 17.275 | ..... | 72.532 | ..... | ..... | ..... |

| Tin | New York | | London | |
|---|---|---|---|---|
| | 1915 | 1916 | 1915 | 1916 |
| January | 34.260 | 41.825 | 156.550 | 175.548 |
| February | 37.415 | 42.717 | 176.925 | 181.107 |
| March | 48.426 | 50.741 | 180.147 | 193.609 |
| April | 47.884 | 51.230 | 166.225 | 199.736 |
| May | 38.790 | 49.125 | 162.675 | 196.511 |
| June | 40.288 | 42.231 | 167.636 | 179.466 |
| July | 37.423 | 38.510 | 167.080 | 168.357 |
| August | 34.389 | 38.565 | 151.440 | 169.870 |
| September | 33.125 | 38.83 | 152.625 | 171.345 |
| October | 33.080 | ..... | 151.554 | ..... |
| November | 39.224 | ..... | 167.670 | ..... |
| December | 38.779 | ..... | 167.000 | ..... |
| Av. year | 38.590 | ..... | 163.960 | ..... |

| Lead | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1915 | 1916 | 1915 | 1916 | 1915 | 1916 |
| January | 3.729 | 5.921 | 3.548 | 5.826 | 18.606 | 31.167 |
| February | 3.827 | 6.246 | 3.718 | 6.164 | 19.122 | 31.988 |
| March | 4.053 | 7.136 | 3.997 | 7.375 | 21.883 | 34.440 |
| April | 4.221 | 7.630 | 4.142 | 7.655 | 21.094 | 34.368 |
| May | 4.274 | 7.463 | 4.182 | 7.332 | 20.347 | 32.967 |
| June | 5.932 | 6.936 | 5.836 | 6.749 | 25.170 | 31.011 |
| July | 5.659 | 6.352 | 5.531 | 6.185 | 24.611 | 28.137 |
| August | 4.656 | 6.244 | 4.520 | 6.088 | 21.946 | 29.734 |
| September | 4.610 | 6.810 | 4.490 | 6.699 | 23.151 | 30.786 |
| October | 4.600 | ..... | 4.499 | ..... | 23.994 | ..... |
| November | 5.155 | ..... | 5.078 | ..... | 26.278 | ..... |
| December | 5.355 | ..... | 5.266 | ..... | 28.807 | ..... |
| Year | 4.673 | ..... | 4.567 | ..... | 22.917 | ..... |

| Spelter | New York | | St. Louis | | London | |
|---|---|---|---|---|---|---|
| | 1915 | 1916 | 1915 | 1916 | 1915 | 1916 |
| Jan. | 6.386 | 16.915 | 6.211 | 16.745 | 30.844 | 89.810 |
| Feb. | 8.436 | 18.420 | 8.255 | 18.260 | 39.819 | 97.762 |
| Mar. | 8.541 | 16.846 | 8.360 | 16.676 | 44.141 | 95.048 |
| April | 10.012 | 16.695 | 9.837 | 16.525 | 49.888 | 99.056 |
| May | 14.781 | 14.276 | 14.610 | 14.106 | 68.100 | 94.217 |
| June | 21.208 | 11.752 | 21.038 | 11.582 | 100.614 | 68.591 |
| July | 19.026 | 8.925 | 18.856 | 8.755 | 97.250 | 50.750 |
| Aug. | 12.781 | 8.730 | 12.611 | 8.560 | 67.786 | 51.587 |
| Sept. | 13.440 | 8.990 | 13.270 | 8.820 | 67.841 | 52.095 |
| Oct. | 12.800 | ..... | 12.596 | ..... | 66.536 | ..... |
| Nov. | 15.962 | ..... | 15.792 | ..... | 88.409 | ..... |
| Dec. | 15.391 | ..... | 15.221 | ..... | 89.400 | ..... |
| Year | 13.230 | ..... | 13.054 | ..... | 67.553 | ..... |

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

| Pig Iron, Pitts. | Bessemer‡ | | Basic‡ | | No. 2 Foundry | |
|---|---|---|---|---|---|---|
| | 1915 | 1916 | 1915 | 1916 | 1915 | 1916 |
| January | $14.59 | $21.60 | $13.45 | $18.78 | $13.90 | $19.70 |
| February | 14.55 | 21.16 | 13.45 | 18.93 | 13.90 | 19.51 |
| March | 14.55 | 21.81 | 13.45 | 19.20 | 13.95 | 19.45 |
| April | 14.55 | 21.65 | 13.45 | 18.95 | 13.95 | 19.45 |
| May | 14.61 | 21.78 | 13.60 | 19.11 | 13.83 | 19.58 |
| June | 14.70 | 21.95 | 13.67 | 18.95 | 13.77 | 19.34 |
| July | 14.94 | 21.95 | 13.91 | 18.95 | 13.68 | 19.20 |
| August | 16.01 | 21.95 | 15.31 | 18.95 | 14.75 | 19.25 |
| September | 16.86 | 22.88 | 15.95 | 19.58 | 15.70 | 19.53 |
| October | 16.95 | ..... | 15.96 | ..... | 15.80 | ..... |
| November | 17.57 | ..... | 16.47 | ..... | 17.20 | ..... |
| December | 19.97 | ..... | 18.44 | ..... | 18.95 | ..... |
| Year | $15.82 | ..... | $14.76 | ..... | $14.95 | ..... |

‡ As reported by W. P. Snyder & Co.